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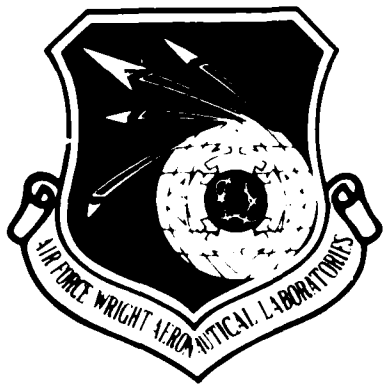

PROPOSED REVISIONS TO MIL-F-8785C RELATED TO FLIGHT SAFETY OF AUGMENTED AIRCRAFT
VOLUME III
APPENDIX G—PILOT COMMENTS

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FLIGHT DYNAMICS LABORATORY
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This technical report has been reviewed and is approved for publication. The opinions expressed in this report are those of the authors and are not necessarily shared by the Air Force.

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New tentative criteria have been developed for airplanes with relaxed static longitudinal stability based on approach and landing ground simulation, but augmented by the available flight test data. It is shown that a criterion based on just time to double amplitude is invalid, and other elements in the pitch attitude transfer function must be included. Criteria based on both closed-loop frequency response and airplane parameters (open-loop) are developed. This report covers the results obtained in one of a series of Air Force programs to update MIL-F-8785, Flying Qualities of Piloted Airplanes.

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FOREWORD

This report was prepared for the United States Air Force by the Boeing Military Airplane Company, Seattle, Washington, in partial fulfillment of Contract Number F33615-78-C-3603, Project 2403, Flight Control, Task 05, Work Unit 21. The report describes proposed revisions to MIL-F-8785C related to flight safety of highly augmented aircraft, especially those with relaxed static stability. The proposed revisions are based on analysis and fixed-base ground simulation.

The contract was under the direction first of Mr. R. Kevin Rowe, then Mr. G. Thomas Black, and finally Mr. David J. Moorhouse, all of the Control Criteria Branch, Air Force Flight Dynamics Laboratory, Wright-Patterson Air Force Base, Ohio. The support and encouragement provided by David Moorhouse are gratefully acknowledged.

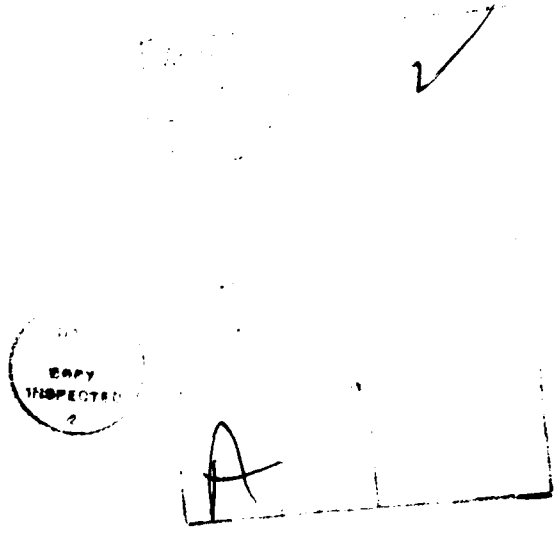
The report represents the combined effort of many people of the Boeing Military Airplane Company, both in Seattle and Wichita. The technical work was under the direction of John M. Schuler, Principal Investigator, and Donald E. West, Program Manager. The accident/incident data analysis was performed by Pete Wylie, assisted by Gary Walker, Ove Moutka, and David Wilson of the Experience Analysis Center.

The proposed revisions to improve compatibility with MIL-F-9490D were developed by Garold Hodges and Olin Visor of the Flight Control Group and Donald Nordwall of the Aerodynamics Group, all of Boeing Wichita. The ground simulations were performed on the Boeing Visual Flight Simulator facility at Kent, Washington, under the trying circumstances imposed by significant off-hours operation, and the personnel of that facility are to be commended for their equanimity and outstanding effort, especially Gene Bird for overall operation and computer programming and Larry Hilliard and Bob Copeland for visual system operation and maintenance. The evaluation pilots, who performed their all-important role with professional competence despite the trials of a compressed and irregular off-hours schedule, were Andrew Messer (Pilot A), Ray McPherson (Pilot R), and Terry Kriha (Pilot T).

Recognition is due Robert P. Harper, Rogers E. Smith, Charles R. Chalk, Robert C. Radford and James Lyons of the Flight Research Department of Calspan Corp. for their assistance in obtaining and

checking out the Neal-Smith computer program, and for many hours of telephone consultation in several areas.

Particular recognition for their substantial analytical effort and technical contribution to the project is due Phillip Gotlieb and Dr. Thomas Liang. For her typing, ability to decipher our unreadable (sometimes even to us) hen scratches, and forbearance, the authors thank Jeanne Hunt. Finally, the primary author would like to express his gratitude to Donald E. West, William Kehrer and Richard McCorkle for their encouragement and support, and for providing the resources for the second simulation program which produced the most significant data used in this study.



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(1) This is an abbreviated table of contents for all three volumes of this report. Complete table of contents for Volume III follows.

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APPENDIX G

PILOT COMMENTS

G.1 Introduction and Notation

The pilot comments for all simulation data runs are found, essentially verbatim, in this appendix. After each run, the pilot tape recorded his comments immediately. They were then transcribed, edited, and are presented here in the order in which they were run. Editing was minimal, consisting primarily of removing "ahs", "ands", etc, and inserting punctuation, done based on listening to the tapes. All added words or comments, not in the pilot's own words, are enclosed in parentheses which are reserved for this purpose.

Each set of runs, normally three, for a configuration are preceded by an identification number, comprised of the date, the run number and the pilot identifier. The configuration is also listed, by identifier, together with qualifying control-surface position and rate limits where they are appropriate. The airplane characteristics corresponding to the configuration identifiers are found in Appendix B, Section B.4.1. Complete definition of the simulation characteristics are found in Appendix C, with Section C.4 and Table C-5 either defining the characteristics or where they can be found. The background and experience of the pilots (A, R, T) are described in Section B.4.5, Appendix B.

Preceding the comments for each run there is listed the individual run number and the type of run (A, B, C, D), generally differing in turbulence intensity, initiation point, and offset of the localizer. These are described in Section B.4.2 under evaluation task. Also listed ahead of the comments for each run are the Cooper-Harper pilot ratings assigned by each pilot as a result of his evaluation of the configuration in the given environment and conditions. The Cooper-Harper rating scale, the performance standards used by the pilots, and the evaluation card used to prompt the pilots in making their comments and assigning a pilot rating are all found in Section B.4.3.

Two sets of pilot ratings were used. The earlier set of ratings, used in the '79 simulation program and the very early runs in the '80 simulation program, were as follows:

PR1) Rating for the ILS portion of the task
PR2) Rating for the visual portion of the task (after break-out at 200 ft altitude)
PR3) Overall pilot rating

Only the first two ratings are considered meaningful, and accordingly, the listed rating ahead of each run uses the following format:

PR1/PR2/N

The N, for not applicable, is included to more clearly identify these earlier pilot ratings.

The second set of pilot ratings, which were used for the larger and more significant amount of data which was run in the '80 simulation program, were as follows.

PR1) Rating for the ILS portion of the task
PR2) Rating for the visual portion of the task after break-out, excluding the flare and touchdown, often called short final
PR3) Rating for the flare and touchdown

All three ratings are listed for each run in the following format:

PR1/PR2/PR3

In the evaluations performed to examine the effect of control-surface rate limits, a combination of the A and B runs was used, called a D run as described in Section B.4.2, to conserve simulation time. For the D runs, four pilot ratings were asked for as follows:

PR1) Rating for inbound and glide-slope acquisition portions of ILS approach, flown in smooth air

PR2) Rating on ILS glide path, flown in moderate turbulence from 900 ft of altitude on down

PR3) Rating for visual portion of task, exclusive of flare and touchdown, in moderate turbulence

PR4) Rating for flare and touchdown, also flown visually in moderate turbulence

All four ratings are listed for the D runs in the following format:

PR1/PR2/PR3/PR4

All pilot ratings, together with any qualifying control-surface position and rate limits, are listed in Table C-9 of Appendix C by configuration. In addition, all formal evaluations perfomed by Pilots A, R, and T are listed in the following Table G-1, Index to Pilot Comments. Included in Table G-1 are the identification number by date and run, pilot, configuration and the page where the pilot comment can be found. The pilot comments and their listing in Table G-1 are given in the sequence they were run. The sequence can often give a clue as to why a rating seems unusually high or low.

It should be noted that run numbers were not always consecutive, nor have all been included. Where runs were suspect, because either a simulation characteristic was in doubt or a simulator malfunction occurred, they have been deleted. However, runs were never deleted because the pilot rating seemed wrong or out of line.

TABLE G-1

INDEX TO PILOT COMMENTS

TABLE G-1

INDEX TO PILOT COMMENTS (Continued)

TABLE G-1

INDEX TO PILOT COMMENTS (Continued)

TABLE G-1

INDEX TO PILOT COMMENTS (Continued)

TABLE G-1

INDEX TO PILOT COMMENTS (Continued)

TABLE G-1

INDEX TO PILOT COMMENTS (Continued)

G.2 Pilot Comments

DATE-RUN: 10/12/79-15 PILOT: R CONFIG: F1

RUN 15-A PR: 4/4.5/N

This configuration left me with impression of negative static stability. Very poor damping in pitch. Looked like it was divergent; however, I could control it quite well. Didn't notice any tendency for it to get away with small inputs anyway. I didn't have to make large inputs. I did notice, however, as I went VFR that there was a slight divergence set up in pitch, but it worked out alright as far as the landing was concerned. You might say we were just lucky, I guess. You had to spike the inputs in order to keep it from pitching on up after an input was made. Airspeed control didn't seem to be any particular problem. Airplane looked better on instruments maintaining glide slope. Rate at about a 4, with instruments as far as ILS; 4-1/2 visually. Flare and touch-down, I'd say, resulted in a start of a very slight PIO but didn't present any real problem. Overall, a 4. Obvious airplane is undamped in pitch, but it can be handled. Apparently there is a pitch augmentation failure involved.

RUN 15-B PR: 4.5/8/N

With moderate turbulence. We did have a stability augmentation failure. Again pitch damping is very low, looks like negative stability in pitch. The turbulence aggravated situation somewhat, though not excessively on the instrument part of the flight. I was able to maintain the glide slope reasonably well on instruments. I'd rate that a 4-1/2. But as soon as we broke out visually the airplane became quite difficult to handle. I guess part of the reason was I was making larger inputs. I found I was getting into a PIO condition and I had to repeat one of the attempts to land. I just was not able to get the airplane down on the runway. On the 2nd attempt, I did land it. However, it did look like it was a little on the firm side. I'd go to an 8 on the visual flare and touch down, 4-1/2 on instrument. Overall pilot rating about a 7. That is something you definitely have to fix, as far as I'm concerned. But you could get the airplane back and probably get it on the ground, particularly under reasonable weather conditions.

RUN 15-C PR: 4.5/8/N

With heavier turbulence, I again found that it was reasonably controllable on instruments. I'd leave pilot rating a 4-1/2 on instruments. However, again, breaking out visually I found that with bigger inputs, I was getting tendency to get into PIO longitudinally, and made the first run without landing, I went around. Second run I was very conscious in trying to keep my inputs small, after I broke out visually, and was able to make what I'd call a satisfactory landing. I'd call it about an 8. You'd have to pick the weather, set yourself up for 3 or 4 passes before you could get one down. It requires considerable workload, in terms of pitch, in order to keep it from going into a PIO that could destroy the airplane. Leave it an 8. With an overall rating of 7.

DATE-RUN: 10/12/79-19 PILOT: R CONFIG: F4

RUN 19-A PR: 7/7/N

With stability augmentation failure. Airplane unstable but seemed to be a little better damped. Looked better to me. I didn't have quite as much trouble flying it. The workload didn't seem quite so high, however, still need spike inputs to stop it, but it seemed like the pitch rates, once they started, were not as fast as previous configuration. Go to a 7 for ILS pilot rating. I didn't have any trouble visually. I made a rather smooth approach to it at the last, keeping the inputs down very low, and again had no trouble with it going divergent. I'd give it 7 for landing. Overall rating 7.

RUN 19-B PR: 7/8/N

With moderate turbulence. I'd leave instrument portion about the same--7, visual an 8. I get the impression that the phugoid just has a longer period to it this time than on the previous ones we've seen. Seems to be just a little more time to help damp out oscillations that occur. However, the turbulence does seem to increase the workload somewhat. Go to 7-1/2 overall rating, 7 for instruments, 8 for visual.

RUN 19-C PR: 7/8/N

With heavy turbulence. I'd leave ratings same as before. 7 for instrumentation, 8 visual, overall 7-1/2. Maybe longitudinal phugoid has a little longer period, or whatever when it comes to trying to damp it, and time to double amplitude has lengthened apparently. It gives me a little more time to correct these unstable conditions. Looks like it is not too bad for an unstable airplane.

DATE-RUN: 10/12/79-20 PILOT: R CONFIG: F2

RUN 20-A PR: 8/8.5/N

Was again with an augmentation failure. No turbulence. Still an unstable airplane. An 8 for IFR flying on the glide slope, and 8-1/2 visually. Was able to get it down, but looked like it was in a divergent oscillation at touchdown. Sink-rate didn't look too high, but it was beginning to build up. Again, just a matter of keeping the inputs down low. A little bit more critical than the previous configuration I saw. I guess I'd go for an overall 8 on configuration.

RUN 20-B PR: 8.5/10/N

Was with moderate turbulence. Made about 3 runs, mostly because of the landing problem. Wasn't able to get the airplane down on the landing. Go to a 10 on the landing, visually. The phugoid, the oscillation that develops is sluggish, can't really control it. I did one time bottom the stick out trying to stop the pitch-up tendency. But I didn't feel I could safely get a landing down in turbulence. It would be one of those things you would want to find a calm day for, before you would want to try to fly it. Make it an overall 10.

RUN 20-C (No run. Assume same as 20-B) PR: 8.5/10/N

DATE-RUN: 10/23/79-1 PILOT: R CONFIG: F4

RUN 1-A (PR: 7/9/N) But use values from repeat below.

Inbound portion of this, as far as IFR flying is concerned, felt reasonably good. However, the airplane was unstable in pitch. I could fly the airplane acceptably well on the localizer, but had to make small inputs. I couldn't make very large ones. Had to counteract any pitch-up or pitch-down tendencies with considerable control in opposite direction. In other words, I had to spike it to stop the pitch rate. But airplane was flyable. I didn't have any particular trouble with the glide-slope acquisition. Had a tendency to make too large an input, I should say, on glide slope as I got down to the lower portion of the approach. This was particularly noticeable on VFR flying. But for ILS I'd say a 7 airplane, working the longitudinal control. Visually I found it harder to control in pitch. I was making larger inputs, attempting to stabilize on the landing approach, and never did make an acceptable landing. Went around 3 times. I think I could eventually get it to where it could be an acceptable landing, but it took a while to get it set up. In smooth air it was getting close to what I would say was landable, but I'd give the flare and touch down a 9. Overall rating an 8, mostly because of the unstable airplane in pitch.

RUN 1-B PR: 7/8/N

With some turbulence. Didn't have any par~~ticular~~ problems with the turbulence. Didn't seem to change the characteristics. Leave it at a 7. Ability to land, it turned out to be a little easier than what I saw from the IFR flying. I was able to get it on the runway without too much touble. I'd put it at an 8 on visual, 7 on IFR. Probably run total airplane at a 7, even though the landing may be slightly more critical VFR. It wasn't as bad as I expected. I guess we just lucked out. Leave it at a 7.

RUN 1-C PR: 8/8/N

With a little more turbulence. About the same results. I was able to stay reasonably close to glide slope and localizer, broke out, and went ahead in and completed the landing. The ability to keep inputs down low in pitch and not get a big oscillation going, I think, is necessary. It still requires some spiking of the column in order to stop the pitch tendency. The airplane is unstable and tends to diverge in either direction if you allow it to go that way. Was able to hold it all the way down. Go to a 8 for both IFR and VFR. Didn't seem to be a lot different than previous run. Still manageable. From what I saw of the calm air, made flying a little easier.

RUN 1-A PR: 7/8/N

Repeated 1-A to take a look at VFR portion of it. IFR again was OK. In smooth air it's not too bad. Rated 7. It is unstable, no doubt it, and you have to make again very small inputs. When we broke out under VFR condition for the approach and landing, I found that the requirement to keep the control inputs low was very high. In other words, you have to work hard making small inputs. It seems to be the thing that is most noticeable. I was able to land it that time without

any particular difficulty, however, it was a rather long landing. Once I got the attitude I wanted for touchdown, I just left it there and let it sink in. I'd put it at an 8 on landing. It looks like it's one that could get away from you fairly easy if you weren't careful of it. It was a satisfactory approach and landing, I thought, under VFR conditions. Leave overall a 7. It's one you'd never allow to go out and fly, with a conditions like this, but if you were stuck with it in flight with some kind of an augmentation failure, I'm sure you could get it home.

DATE-RUN: 10/23/79-1B PILOT: R CONFIG: F6

RUN 1B-A PR: 7/7/N

Looks to be better than previous (than Run 1). The control characteristics were nothing too unusual. I didn't have to use the spike technique quite as much in longitudinal that time. It looked like a better configuration to me. However, the configuration was still unstable, but easier to control. The glide-slope intercept and maintaining glide slope was a little bit better. I guess I would put the airplane in a 7 category again, just because of the fact that it's unstable, but it's a better configuration than the one I looked at before. I don't think we'd want to fly the airplane initially with this kind of failure. Visually it was a 7. Able to get it down in smooth air without too much trouble. I didn't notice any tendency for large inputs at all. When we went visual we were pretty much lined up. Didn't have to disturb the airplane much, but I'd give it an overall 7. It's a better configuration than the one we looked at earlier. The reason I'm not going to give it a 6 is that I don't think you can find yourself in a situation like this flying an airplane under these conditions. You wouldn't actually be flying it under these conditions. You have to insist on whatever failures are involved here being fixed. It's not too difficult an airplane to fly even though it's unstable.

RUN 1B-B PR: 7.5/8/N

Was repeated with turbulence. ILS portion was a 7-1/2. Put VFR portion at 8. The first time I had to go around because of some porpoising that looked like it would result in a fairly heavy sink-rate at touchdown. There is a tendency to oscillate in pitch because of the unstable airplane. Turbulence seems to aggravate this one a little more than on the previous runs. The smooth air conditions looked quite a bit better than the turbulence. Run the airplane up to an 8 in this turbulence. Overall airplane an 8. Put IFR 7-1/2, VFR 8.

RUN 1B-C PR: 7.5/8/N

With heavier turbulence, couldn't see any difference. Able to make a reasonable approach and landing with that out of the first approach. Although a bit long, it looked reasonable. I'd leave it at an 8 overall, 7-1/2 for IFR, 8 for VFR portion.

DATE-RUN: 10/23/79-2 PILOT: R CONFIG: F2

RUN 2-A PR: 8/8.5/N

Lateral-direction satisfactory. Pitch response is definitely less desirable now than what I've seen before. There is more of a tendency for PIO and requires higher workload in order to stay on glide slope. Did notice tendency for air speed to increase a little more in this case. I guess I had a tendency to ride a little high to begin with, and then had to get down on glide slope later, but airspeed control was taking a little more of my attention. The glide-slope acquisition was accomplished, but I'd say the work load in pitch was noticeably higher once you got on it and tried to maintain it. Even though it was smooth air, I'd go to an 8. Under visual conditions, able to keep inputs from creating any porpoising that I couldn't handle. It was very close to being what I'd call a disaster. I guess I'd have to go to an 8-1/2, overall airplane an 8. Flare and touchdown about 8-1/2. Definitely more a problem in VFR than IFR, again because of the inputs tending to be smaller under IFR conditions. A pilot would need a long runway in order to make sure he doesn't get into a porpoise, control sink-rate through the throttle in order to make sure he gets down. Once he's got an attitude, "just try to hold it," seems to be the approach I'd take. However, it is an unstable airplane in pitch.

RUN 2-B PR: 8.5/8.5/N

With turbulence, work load went up in pitch as a result of turbulence. I was able to stay reasonably close to the glide slope. Landing came out satisfactory. Looked like it might have been a little firm, on a slight porpoise tendency. Leave at 8-1/2 in this turbulence in both VFR and IFR.

RUN 2-C PR: 9/9/N

With heavier turbulence. Workload definitely went up both IFR and VFR. Having trouble getting things to stabilize out. In fact, it wouldn't in the turbulence we had, but I could control it. I'd put it at about a 9. We never did make a landing, went around twice. However, I think part of it was because the simulator visual scene was disconnecting at a certain point down the runway. I think if we'd had it longer, with the idea of touching down a little longer, further down the runway, I think we could have controlled it and landed the airplane. But the workload is definitely higher, and the airplane is more difficult to fly. Right on the edge of getting into a porpoising that would be catastrophic, if you just happened to get on the wrong side of the cycle. In other words, the high rate of descent cycle of the porpoise would get you into trouble. But a pilot could pull out of it quickly and go around if necessary, so it'd be a matter of running a series of approaches until he could get one that he's satisfied with. But if you had any choice, you'd sure find a field with smooth air. Close to a 9.

DATE-RUN: 10/23/79-3 PILOT: R CONFIG: AFO

RUN 3-A PR: 2/2/N

In smooth air, no augmentation failure, pretty good airplane. Put at a 2. No particular problems one way or another. Inputs were quite small. I seemed to have good damping in both pitch and roll. There was one time when I thought I detected a slight over-controlling tendency in pitch, to porpoise, but that was when I was on instruments and it didn't persist. I wasn't conscious of it all the way down. I didn't notice it, particularly, on the flare for landing. I'd put the IFR, VFR and overall rating at a 2. Quite easy to fly.

RUN 3-B PR: 2.5/2.5/N

With turbulence, didn't present any particular problems. I'd go 2-1/2 on it both IFR and VFR. Turbulence level didn't seem to have a big effect on it, work load went up slightly. But nothing unusual about control requirements. Reasonably good to me.

RUN 3-C PR: 2.5/3/N

With turbulence, leave IFR portion 2-1/2, 3 on VFR. Tendency to bounce around a little more noticeably in VFR. Tended to be a little bit long in the landing, nothing again unusual. Just the workload going up with turbulence. Airplane response to control inputs was good. Didn't need large inputs. Seemed to respond to whatever I wanted to do with it. Not hard to keep on centerline. Looked reasonably good. Leave overall rating a 2-1/2. Not a big difference between the two levels of turbulence, but did notice a little more tendency to miss my touchdown point and float a little on the landing.

DATE-RUN: 10/23/79-4 PILOT: R CONFIG: AF2(δh_{LIM} = -10/10)

RUN 4-A PR: 2/2.5/N

In smooth air. Configuration didn't look a lot different from 3, can't say I can really see much difference. Leave IFR portion at a 2. When I went VFR, I had a tendency to level off a little bit high, and I found that by attempting to force it to come on down, I wasn't getting quite the response I wanted from small inputs. But I ended up with visual scene looking a little high when we actually got the indication of touch down. But we were floating and wasn't aware of just why it was. But there was something a little bit different about the configuraion that was not as good as the previous one, so I'd go to a 2-1/2 on the landing portion. Overall airplane a 2, but not as good as previous configuration, though very subtle differences.

RUN 4-B PR: 2.5/2.5/N

With turbulence. Worked out reasonably well that time. Didn't see any particular problems with either IFR or VFR. I would probably go 2-1/2 IFR and VFR, overall 2-1/2. Reasonably good airplane. Turbulence didn't effect any of the control input requirements or didn't show up any tendency for porpoising or anything that was annoying. I was able to get my touchdown point without too much difficulty. Worked out good.

RUN 4-C PR: 3/3/N

Heavy turbulence. About all it did was increase the work load. I'd go to a 3 on both IFR and VFR . Still handled reasonably well. Ended up floating a little on the VFR portion of the landing, but was still controllable. Responded well to inputs. Didn't have any particular trouble in lateral or pitch. Give it an overall 3.

DATE-RUN: 10/30/79-3 PILOT: R CONFIG: AFO

RUN 3-A PR: 2/2/N

Run 3-A was without any turbulence. The feel system seems satisfactory, forces are OK, sensitivity looks good. No problem with the lateral-directional. Didn't notice any tendencies to porpoise or anything unusual about the configuration. Airspeed control was very normal. Glide-slope acquisition was satisfactory and was able to stay reasonably close to the glide slope on the way down. I would give it a pilot rating of a 2. Under visual conditions it is still a 2. There are no problems in either lateral or longitudinal that showed up, and I was not aware of any particular change in my techniques between the IFR and the VFR portion of it. It was about the same under instrument flying conditions as it was under VFR. The flare and touchdown is a 2. It worked out reasonably good. The overall rating is a 2.

RUN 3-B PR: 2.5/2.5/N

Was with turbulence. Nothing unusual about it. The airplane responds very well to inputs of turbulence. The offset lateral maneuver is easily controlled. No tendencies for over-controlling and the pitch was also very good in moderate turbulence. I would give an overall 2-1/2. It looked very good to me.

RUN 3-C PR: 2.5/2.5/N

Was just a little heavier turbulence, yet I can't say there was much difference in the B and C runs. I would leave it at 2-1/2. Nothing unusual about the airplane and the turbulence. It takes a very small stick displacements to fly it and airplane feels good in this turbulence. I am leaving the rating at 2-1/2.

DATE RUN: 10/30/79-4 PILOT: R CONFIG: AF2(δh_{LIM} = -10/10)

RUN 4-A PR: 2/2/N

Calm air - everything seemed to be good. I couldn't see any difference really between this run and the previous run. I would leave it at a 2 for the VFR and IFR flying. Airplane responded well and no particular problems. I did have a tendency to hold a little high on the airspeed, during the middle portion of the descent on the glide slope while on instruments, but I had good control of it and didn't create any problem in getting back to the proper speed prior to landing. Didn't see any big difference between the visual and the instrument flying. I would leave the overall rating at a 2.

RUN 4-B PR: 2.5/2.5/N

With turbulence. I repeated this run twice. The first run I had a tendency to get a little bit high on the glide slope just prior to breaking out, but the turbulence didn't seem to have a big effect on the way the airplane is flying. I would just go to a 2-2/2 overall with it. I didn't have any trouble at any time. It takes very small inputs to get good response and the airplane feels reasonably good. The same rating for both VFR and IFR.

RUN 4-C PR: 3/3/N

Was in heavier turbulence. I would go to about a 3 on that. Overall I was having a little more difficulty holding the glide slope and localizer, and I noticed that after I broke out VFR, that I had a little more trouble finding the runway in terms of the flare, and I ended up landing a little bit long. It tended to ballon just a little. I don't know if it was caused by over-controlling or just turbulence. I would go for 3 on IFR, VFR and overall. It still responds quite well to small control inputs.

DATE RUN: 10/30/79-5 PILOT: R CONFIG: AF2(δh_{LIM} = -7/10)

RUN 5-A PR: 2/2/N

The configuration still looks very similar to what we had when we started. Nothing unusual about it. I would still leave it at about a 2. If I had to say that it was different, I would say that it was not quite as good, but it is still a fairly easy flying airplane. I didn't see anything different about the IFR and VFR and rate them both a 2. I did make some pulses along the glide slope during that run just to try to get a little better feel for the longitudinal characteristics, but the landing looked fine. We will see some inputs there that drove me off the glide slope for a little bit, but that was my own doing - nothing in the airplane caused it. I would leave it a 2.

RUN 5-B PR: 2.5/2.5/N

Was with some turbulence. I didn't notice any real significant changes while on instruments. I would call it a 2-1/2 on instruments. It responded well in the turbulence. I did notice after we broke out that there was a tendency to use more control, particularly the condition just short of the runway. I felt like I had to put in a little more abrupt flare to account for what looked like sink at the end there. But the airplane responded well to it and didn't look like it created any problem. The landing looked reasonable to me. I would leave them at 2-1/2. Overall 2-1/2.

RUN 5-C PR: 2.5/3/N

Was with heavier turbulence. I couldn't say that I felt the effect of the heavier turbulence at all. It seemed to be about the same as the previous run. The only difference I noticed would be in the VFR portion of it after I attempted my flare for landing. There was a tendency to float a little. I ended up going down past the touchdown point somewhat. Part of that could have been caused by - - I noticed a little drop in air speed prior to getting to the end of the runway about the

time we broke out. I might have had a little more throttle than I needed to correct for it and had a little excess speed to bleed off. But it still handled well and I was able to keep a fairly low sink-rate close to the runway. I would probably go to a 3 on the visual. I would leave it at 2-1/2 on the instrument portion, and I will make the overall rating a 2-1/2. But the visual would have gone to 3 because of the tendency for floating, but that was just due to turbulence I am sure.

DATE RUN: 10/30/79-6 PILOT: R CONFIG: AF2(δh_{LIM} = -5/10)

RUN 6-A PR: 2/2/N

Was without turbulence. Again, I can't see anything unusual about it. Good response all the way around. Forces are OK, both laterally and longitudinally. I didn't notice any difference in the VFR and the IFR. I am still going to go for around a 2 with the airplane. Speed control seemed to be satisfactory. I would put it at a 2 for both IFR and VFR and overall.

RUN 6-B PR: 2.5/2.5/N

Was with moderate turbulence. Had no particular effect on it. I would go for a 2-1/2 all the way around. One thing I noticed - after VFR I had to make a final correction in lateral just short of touchdown, but I had good response in both lateral and longitudinal to effect the touchdown and put it about where I expected it to be. It is a 2-1/2.

RUN 6-C PR: 3/3.5/N

Was with heavier turbulence. The IFR portion of it was still about the same. I would go to a 3 maybe on the IFR portion. It is just due to the heavier turbulence that the work load has gone up a little, but it is still not too bad an airplane. I noticed that when I broke out VFR, I seemed to work a little harder to get the airplane down and I ended up causing a ballooning tendency a couple of times. I don't know whether it was turbulence or the airplane that was really responsible for it, but I ended up quite a ways down the runway and I am going to put that at a 3-1/2, and 3 on the IFR. I would leave the overall airplane at a 3.

DATE-RUN: 10/30/79-7 PILOT: R CONFIG: AF2(δh_{LIM} = -3/10)

RUN 7-A PR: 4/4/N

Left me with the impression that the airplane was more sluggish in pitch. Laterally it was OK, no problem there, but I got the impression that maybe the sensitivity had decreased or something had changed in the pitch axis that reduced the response that I was getting. I seemed to need more column for a given response. I could fly the airplane satisfactorily but it just wasn't as good handling and I tend to put the visual and the instrument both at about a 4. I think I had a little more trouble with the instrument flying. I was making some inputs while making the approach on the glide slope that probably accounted for part of the activity, just to see how it would respond, and I wasn't staying

right on it all the time. But I got the impression that, because of those inputs, we were sluggish. I am going to leave the overall rating at a 4.

RUN 7-B PR: 4.5/6/N

Was with moderate turbulence and I wasn't too conscious of any difference - significant difference - in the pitch response during the IFR portion of it. I would go for about a 4-1/2 on the IFR. But once we got VFR, I noticed that the sluggishness of response in pitch was more noticeable. I made about three attempts on the landing, coming out of an offset from the right, before I was really satisfied that I could get the airplane down. I would go to about a 6 on the response characteristics in the moderate turbulence under VFR conditions. This means that you are needing a longer runway to kind of feel it out, and you have got to get the lateral input out as soon as possible so that you can concentrate on pitch and getting it down to the runway. But it is an overall 5 in moderate turbulence.

RUN 7-C PR: 5/7/N

In this heavier turbulence it is about a 5 on instruments. But it goes to at least a 7 when I get visual. I'm having a little trouble with it on landing because of bottoming the stick a couple of times trying to stop the high sink-rate. I didn't feel like I had crashed it, or anything like that, but I did repeat the run at least once. I get the impression that, after a certain stick deflection, the sensitivity or the inputs of the stick are no longer really very valid. It just feels very sluggish, like I'm getting way behind the airplane. It doesn't look like it is an unstable airplane. It looks like, from a static longitudinal standpoint, that it is OK. It has reasonable damping and there might be a rate limit or something like that showing up on the elevator. I am just not having the control with it that I should have, and had seen on earlier configurations. I would go an overall 6, but I will put the landing in this heavy turbulence at a 7.

DATE-RUN: 10/31/79-13 PILOT: A CONFIG: AF111-F

RUN 13-A PR: 2.5/2.5/N

Feel forces, sensitivity and lateral-directional control are all OK. Pitch response, no problems. No PIO tendency. Pitch response tends to be a shade stiff, it wants to stay put, it takes a little more of a nudge than it could to move. Airspeed is no particular problem. ILS glide slope acquisition is OK. Maintaining glide slope is pretty easy. Pilot rating 2-1/2 ILS. Visual: pitch control, lateral maneuvers were all OK. Difference (of visual) from ILS: essentially same difficulty. Flare and touchdown all straight forward, again about a 2-1/2. Overall pilot rating 2-1/2.

RUN 13-B PR: 4/4/N

Effect of turbulence brought out the sluggishness to respond in pitch. Pitch changes did not result right away in a vertical speed change, and it took more of a pitch change than would be expected to get the desired performance. This made following the glide slope and turbulence more difficult both in visual and ILS. Lateral maneuver

complicated the situation but didn't really change the basic problem of not getting the rate of descent changes required with small pitch changes. Pilot rating 4.

RUN 13-C PR: 4/4/N

Effect of turbulence remains pretty much as in B. Points up the reluctance of the airplane to respond to small pitch changes with desired vertical speed changes. Balloons even though the nose attitude is down, and so forth as a result of the gusts, rather than descending when you want it to, and vice versa. Visual and ILS are essentially the same. Pilot rating remains a 4.

DATE RUN: 10/31/79-14 PILOT: A CONFIG: AF111-G

RUN 14A PR: 2/3/N

Feel forces, sensitivity, lateral-directional all OK. Pitch response seemed to be quite a bit more responsive this time. The ability to control vertical sppeds seemed to be a lot more solid. No PIO tendency or special inputs, other than the fact that the pitch was noticeably more sensitive. Airspeed control is no problem. Glide-slope acquisition was good. Maintaining glide slope was pretty easy as far as ILS. Rating of 2. Visual pitch control perhaps tended to be a little touchy. Lateral maneuver - none was required here. The difference (of visual) from the ILS seemed a little bit harder. Flare and touchdown, on the visual, tended to be a little too sensitive. Visual, a 3. Overall, 2-1/2.

RUN 14-B PR: 2/3.5/N

Effect of turbulence was noticeable. But the more sensitive pitch and response of the airplane was very good on ILS portion. It remains a 2. Turbulence magnified the tendency to over control on the visual, however. Make the visual a 3-1/2. Lateral maneuvering didn't really complicate things too much. It did tend to de-stabilize the approach a little. On the visual, has a slight tendency to over control in pitch, which I don't understand. Overall rating, with turbulance, 2-1/2.

RUN 14-C PR: 2/3.5/N

Effect of turbulence remains as before. Response of airplane during ILS portion seemed very good on instruments and the ability to track the glide slope even in heavy turbulence seemed very good. Remains a 2. Visual portion, same tendency to have the sensitive pitch attitude, that helps on the instruments, hinders on the visual and it remains a 3-1/2. Overall, 2-1/2.

DATE-RUN: 10/31/79-15 PILOT: A CONFIG: AFO

RUN 15-A PR: 3/3/N

Feel forces, sensitivity, lateral-directional OK. Pitch response here appeared to have a little bit of spring-back tendency. In other words, you put in a slight input and the pitch would move but as you release the input it would tend to bounce back at you a little bit. No particular PIO tendency. Special inputs might have been just a little more attention required to make sure you got the pitch input you want and

kept it. Airspeed control was no problem at all. Glide-slope acquisition and maintaining glide slope was relatively easy. Airplane stayed on rate of speed that you programmed it for, but maintaining the pitch attitude to do it required a bit of attention. Make ILS a 3. In visual, pitch control, lateral maneuvering were essentially the same, visual was the same as ILS, flare and touch down the same, a 3. Overall a 3.

RUN 15-B PR: 3/3/N

Effect of turbulence was noticeable but I was able to control the airplane pretty easily through it. Visual: the effect of the lateral maneuver was not greatly adverse. The overall rating a 3 for ILS and flare and touchdown.

RUN 15-C PR: 3/3/N

Effect of turbulence more noticeable but the ability to fly the machine seemed essentially the same. You could put it pretty much where you wanted it, and fight the effects of turbulence successfully. Again, a 3 for ILS and the flare and touchdown. Overall, 3.

DATE-RUN: 10/31/79-16 PILOT: A CONFIG: F1

RUN 16A PR: 5/6/N

Feel force, sensitivity, lateral-directional all OK. Pitch response: very noticeable instability in pitch or lack of stability, with a tendency towards PIO if you're really not on top of it. Special inputs: require countering that tendency. Airspeed control is somewhat more difficult than previous cases. Glide-slope acquisition and maintenance are OK, but they do take considerable amount of effort to counter the pitch instability. I would give ILS portion a 5. The visual pitch control had a tendency to be more difficult. No lateral maneuver was really required but it seemed more difficult than the ILS portion. Flare and touchdown a 6. Overall rating, 5.

RUN 16-B PR: 6/8/N

Effect of turbulence very noticeable, accentuating the PIO tendency. The ILS portion is a 6. In visual, flare and landing, the PIO tendency is such that we reached limits on the elevator trying to counter it, which essentially made the airplane uncontrollable, which gives it a 10. The overall, I think if you're very very careful and don't allow the PIO to get away, you can probably manage to keep it under control, but that would still qualify it for an 8 or 9 overall. (See Run 16-C for modifying comments.)

RUN 16-C PR: 6/8/N

ILS portion is quite difficult due to turbulence, but we can stay on the glide slope within reasonable tolerance making ILS portion a 6. Ability to land the airplane where you want to put it is seriously degraded, which makes the rating of the visual and flare and touchdown an 8. The airplane can be flown. It can be taken around in a go-around and control maintained, but trying to land it will not always result in success. This would also apply to the previous case. Rather than a 10,

the visual should be 8 because control can be maintained by going around, although the desired performance can't always be obtained. Overall rating for the C case would be an 8, and also for the B case.

DATE-RUN: 10/31/79-17 PILOT: A CONFIG: F2

RUN 17-A PR: 9/9/N

Feel forces, lateral-directional and sensitivity all OK. Pitch response noticeably very unstable. Not so much a PIO tendency as inability to damp out the unstable oscillation tendencies. It takes considerable attention just to maintain the pitch attitude. Air speed control is noticeably difficult, probably due to the pitch excursion that are not entirely under control. ILS, glide-slope acquisition and maintaining glide slope are quite difficult. However, you can generally stay in vicinity of the glide-slope. Question of losing control of aircraft is constantly there, and occasional glide-slope excursions outside of the acceptable limits are always present. Overall rating of ILS and just basic instrument flying of the airplane about a 9. Visual pitch control remains the same. Lateral maneuver tends to complicate the situation with considerable amount of care and not disrupting anything. You can land the airplane but it's about the same difficulty as the ILS. Flare and touchdown: I really didn't flare, just maintained the basic ballistic trajectory of the aircraft towards the end of the runway and just cut the power and let it hit. In the first pass and attempt to try to flare, I totally lost control of the airplane. Flare and touchdown, 9. Overall, 9.

RUN 17-B PR: 9/10/N

Effect of turbulence made controlling airplane marginal. Effective of lateral maneuver was effectively countered by the fact that I wasn't on the centerline and the offset compensated, and we came out pretty much on course. But the ILS glide slope portion was a 9. Flare and touchdown a 10. Overall for the task would be a 10 for the reason I wasn't able to execute a successful go-around.

RUN 17-C

Effect of heavy turbulence was as before, increasing difficulty of controlling the aircraft considerably. The ILS glide slope portion, a 9. Landing, flare, touchdown, a 10. Overall, a 10 for the reason that once you begin to lose it, you can't get it back.

DATE-RUN: 10/31/79-18 PILOT: A CONFIG: F4

RUN 18-A PR: 5/5/N

Forces, sensitivity, lateral-directional all OK. Pitch response, very noticeable pitch instability. Maybe some slight PIO tendency, but there seemed to be a considerably larger amount of control power available to counter and damp the pitch instability making the aircraft much more controllable than the previous case. ILS glide-slope acquisition required considerable attention to maintain glide slope, but it was possible to attain adequate performance on the glide slope. ILS glide-slope portion is probably a 5. Visual: pitch control essentially the same. Pitch excursions were quickly damped with a kind of pulse to

the stick as long as you don't leave it in too long. No lateral maneuver was required this time. ILS and visual seemed about the same difficulty. Flare and touchdown about 5.

RUN 18-B PR: 6/6/N

Effect of turbulence increased amount of attention required to fly the aircraft. However, adequate performance can be maintained with substantial amount of pilot attention. ILS glide slope and visual, flare and touchdown, all a 6. Overall, a 6.

RUN 18-C PR: 6/7/N

Effect of heavy turbulence is the same. It requires extensive compensation to fly the airplane. The ILS glide slope and the touchdown, there is a slight tendency to overcontrol in flare and touch down in this and also in B case, but it can be countered. In this case, in the heavy turbulence, the ILS remains about a 6. The flare and touchdown is a 7. Borderline whether you can maintain adequate performance, and sometimes the control of the A/C is somewhat in question, but you're still in charge--but barely. Overall rating for heavy turbulence case a 6.

DATE-RUN: 10/31/79-19 PILOT: A CONFIG: F6

RUN 19-A PR: 6/6/N

Forces, sensitivity, lateral-directional all OK. Pitch response: very noticeable instability, PIO tendency, but it's compensated by a lot of attention countering the excursions. Airspeed control, not too difficult. Glide-slope acquisition, maintaining glide slope required a considerable amount of attention. Pilot rating for ILS glide slope, a 6. Visual: pitch control, lateral maneuver essentially the same as long as I didn't let it get away and didn't try to put in too much of an input, you're able to maintain control and herd it in the general direction you want it. Flare and touch down -- with an extreme amount of care you can get it to land acceptably, making it a 6. Overall, a 6.

RUN 19-B PR: 6/6/N

Effect of turbulence was noticeable and the effect of large lateral maneuver was very noticeable, but the ability to maintain the glide slope and flare and touch down - I was still able to keep the airplane within adequate tolerances, effect reasonable landing and touchdown. Overall rating of 6.

RUN 19-C PR: 6/6/N

Effect of turbulence: heavy turbulence still was compensated for with seemingly no more difficulty than without it. Airplane still quite difficult to control, but the turbulence seems to have less adverse effect on this configuration than it did on some of the previous cases. Overall rating remains a 6. [Test engineers notes give PR: 6/6/6.]

DATE-RUN: 10/31/79-20 PILOT: A CONFIG: AF2

RUN 20-A PR: 3/2/N

Feel forces, sensitivity, lateral-direction OK. Pitch response: no PIO tendency. Airplane very stable, tends to have a slight resistance to do what you want it to do, almost overly stable. You put in a little

bit of a pitch change to effect vertical speed and it sometimes takes a little bit more to get what you want. Airspeed control was no problem. ILS, glide-slope acquisition and maintaining glide slope, no problem. Pilot rating a 2. The visual: pitch control, lateral maneuvers, was not very difficult. If anything, slightly easier than the ILS. Flare and touchdown a 2. Reviewing the handling qualities rating (scale definition), let's make the ILS glide-slope portion a 3, visual a 2, overall a 2.

RUN 20-B PR: 3/2/N

Effect of turbulence was noticeable and perhaps accentuated the complaint about the slight resistance to getting the performance desired with small pitch inputs, however the overall pilot rating remained the same. ILS glide-slope portion is a 3, flare-touchdown a 2, overall a 2.

RUN 20-C PR: 5/5/N

The effect of turbulence was noticeable in that it set up sink-rates and updrafts that were much more difficult to control than I would expect from the stability of the airplane, and perhaps that contributed to it. The tendency was to either get an updraft or sink-rate going, and try to compensate for it, and the airplane didn't seem to want to respond. It made the ILS portion much more difficult and in the flare-touchdown the same tendency existed. Made 2 runs. It would appear to be about a 5 overall, for ILS glide-slope, flare-touchdown and overall.

DATE-RUN: 10/31/79-16A PILOT: A CONFIG: F1

RUN 16A-A PR: 4/4/N

Feel forces, sensitivity, lateral-directional all OK. Pitch response: noticed a very definite instability that was relatively easy to counter. Not so much a PIO tendency as just an instability. Special inputs: basically required a counter g of the pitch instabilities. Airspeed control was not a problem. ILS glide-slope acquition and maintaining glide slope required attention, but not an excessive amount. Rate at a 4 for ILS. Visual: no lateral maneuver required. This case didn't seem that much more difficult than the ILS. Flare and touchdown: perhaps again a 4. Overall, 4.

RUN 16A-B PR: 4/5/N

ILS portion remains a 4. Offset tended to make flare and touchdown a little more difficult, and required a considerable amount of attention to hang in there. But about a 5 for flare-touchdown. Overall a 4.

RUN 16A-C PR: 4/5/N

Remains same as 16-B. ILS a 4. Flare and touchdown a 5. Heavier turbulance as difficult as the lateral maneuver, and overall about a 4. For some strange reason the aircraft performance responds very well to small positive inputs. Small pitch changes and power changes result in desired vertical speed changes to maintain glide slope and set a decent flare. Pitch attitude tends to be quite unstable but is well damped with acceptable amount of countering from pitch inputs. The fact that you get what you want, is what really gives this case a rating of a 4 rather than

a higher number, although at first glance the instability in pitch would seem to warrant a much higher number. But, since you can get what you want out of it, it doesn't work out that way.

DATE-RUN: 11/5/79-21 PILOT: A CONFIG: AFO

RUN 21-A PR: 2/2/N

Forces, sensitivity, lateral-directional control all OK. Pitch response, no problem. Appeared to be a slight tendency to be more reactive than the basic practice pattern we just did. Slight pitch inputs tend to slightly overshoot the desired pitch, but no particular problem. Airspeed control, no problem. Glide-slope acquistion and maintaining glide slope were no problem. Pilot rating 3. Visual: pitch control OK. Lateral maneuver not required. It seemed slightly easier than the glide slope and flare and touchdown. Call it 2. Overall a 2-1/2.

RUN 21-A (Repeat)

Pitch response is more sensitive than the basic case, but appears to be also quite stable. You turn it loose and it pretty much stays where you leave it. No PIO tendencies. Special inputs: requires a light touch but actually more desirable than previous case. Airspeed control, easy. Glide-slope acquisition, maintaining glide slope were very nice. Pilot rating a 2. Visual: pitch control, lateral maneuvers were OK. About same as glide slope, flare and touchdown a 2. Overall pilot rating a 2, or perhaps slightly better. The problem on the first run might have been just a little slow on my part getting started and I was somewhat off glide slope and never really got caught up. Didn't really give it a fair shake. Seems to be a very solid, very responsive aircraft to fly this time. Seems to be good.

RUN 21-B PR: 2/2/N

Pitch control was excellent. Effect of turbulence was not too degrading. The airplane seemed to plow through it OK. I got a little bit behind it, close in, but I think that was my slight inattention. Lateral maneuver didn't complicate the situation much. Pilot rating remains about a 2.

RUN 21-C PR: 2/2/N

Effect of heavy turbulence was quite noticeable, particularly in up and down drafts. Took reasonable amount of compensation from standpoint of flying the airplane to take care of that, but the airplane seemed to respond very well. It's very sensitive. This particular time I was somewhat rough with the controls, just to try to aggressively handle the gusts. Airplane still managed to do what I wanted it to, and I put it down where I wanted it. From that standpoint it remains a 2.

DATE-RUN: 11/5/79-23 PILOT: A CONFIG: F1

RUN 23-A PR: 3.5/3.5/N

Forces, sensitivity, lateral direction all OK. Pitch response: no real excessive problem. The fault light is on. The actual response of the A/C is only a minor problem. It tends to overshoot in pitch if you're not careful, but it was easily controlled. A slight counter input was only special input required to catch it. Airspeed control was no

problem. ILS glide-slope acquisition and maintaining glide slope were not seriously degraded. Pilot rating is, for this case with no turbulence, a 3-1/2 because it does warrant improvement, but it didn't really take more than minimal pilot compensation. It's kind of a cross of those two descriptions. Visual: pitch control was no problem. Lateral maneuver not required. Easier than ILS. Flare and touchdown no real problem. Visual, again 3-1/2. Overall a 3-1/2.

RUN 23-B PR: 4/7/N

Effect of turbulence on the ILS glide-slope portion was not really a problem. It took some compensation to accommodate it. ILS glide-slope portion a 4. Flare and touchdown, in two attempts, had some interesting side effects. The question of control was never in doubt, but there was a definite PIO tendency in the flare that seemed at the limit of the ability to handle making a predictable touchdown spot not possible. That would make visual, flare and touchdown a 7. Overall rating would have to be a 6.

RUN 23-C PR: 4/5/N

Effect of turbulence very noticeable. ILS glide-slope portion a 4. The flare-touchdown was more like a 5, although I felt that there was a very strong tendency for the same problem as on the B case to crop up. Perhaps due to the fact that I deliberately made very small inputs and just kind of rode the turbulence out rather than put in larger inputs and counter it, I never lost ability to stick the airplane where I wanted it. It just kept kinda plowing through by not putting very much input in. The previous case, the trouble seemed to arise when I put in too much of an input and it seemed suddenly to run out of control. By deliberately limiting my inputs and keeping them small, I was able not to get into the PIO problem. And by avoiding that regime, the flare and touchdown is about a 5. If I'd not been cautious, the situation could have been considerably worse. Overall, a 5. Basis for the 5 is in the nature of the compensation, in being aware that small inputs are all that are permitted. If you get into a large case, then it can very rapidly deteriorate.

DATE-RUN: 11/5/79-24 PILOT: R CONFIG: F2(δh_{LIM} = -25/10)

RUN 24-A PR: 6/5/N

Forces, sensitivity and lateral-direction OK. Pitch response: very noticeable instability with a slight PIO tendency. Inputs require a fairly large pitch input of very short duration to get desired pitch changed, followed generally by a counter input of the same nature. Airspeed control is not a particular difficulty. Considerable amount of attention was required to maintain pitch attitude and performance. ILS glide-slope acquisition and maintaining glide slope were quite difficult, and I was not able to keep the aircraft within acceptable limits for glide slope during most of the ILS phase. I would rate ILS portion a 6. Visual: no lateral maneuvering required. It seemed easier than the ILS portion. Flare and touchdown were difficult, but the rating for that would be 5. Overall, a 5.

RUN 24-B PR: 6/7.5/N

Effect of turbulence complicated the pitch problem considerably. The ILS glide-slope portion was noticeably more difficult. I rate that a 6. Visual portion and the lateral maneuver was such that I was unable to put airplane where I wanted it safely. Still able to control it and execute a go-around, although barely. Visual portion a 7-1/2. Overall, a 7.

RUN 24-C PR: 7/8/N

ILS glide-slope portion was difficult. Unable to maintain acceptable parameters on the glide slope due to the battle with the pitch instability. This a 7. Flare and touchdown: again PIO tendency during transition to visual and flare was such that even with limit controls I was unable to stabilize the airplane for a safe landing. However, we were able to go around. The visual is an 8. Overall, a 7-1/2.

RUN 24-B & C NOTE

During go-around phase, when full power was applied and pitching to about 15 degree attitude to execute a climb, the stability or the ability to control the airplane seemed to settle down and it seemed easier to fly as it climbed away from the ground than during the flare portion on the approach.

DATE-RUN: 11/5/79-25 PILOT: A CONFIG: F2(δh_{LIM} = -25/15)

TEST ENGINEERS NOTE:

Configuration F2, the most unstable F case, prior to this run used the normal F-111 control limits for pitch or horizontal tail deflection, 25° nose up and 10° nose down. Because of Pilot R's comments in Run 24 of using limit controls, nose-down horizontal tail deflection was increased to 15° in Run 25. This greatly reduced the limiting, eliminated his comments concerning it, improved the pilot ratings and was used subsequently. Later, nose-down deflection was increased to 20°, nose-up to 30°.

RUN 25-A PR: 5/7/N

Forces OK, sensitivity OK, lateral-direction all OK. Pitch response: very noticeable instability. Slight PIO tendency. Special inputs as before required a fairly large input of short duration, countered to stop an overshoot with similar input in the opposite direction. Airspeed was not too much of a control. Glide-slope acquisition and maintaining glide slope during the initial phases were not too difficult, over and above maintaining the stability of the aircraft. The ILS portion would be a 5. Visual: PIO tendency made it much more difficult. Flare and touchdown: we were able to touchdown but not with the type of control that would be considered acceptable performance. The tendency to overshoot resulted a couple of times reaching the limits on the controls. Trying to damp out the pitch oscillations resulted, in this case, in a fairly hard landing. ILS (Pilot must have meant "visual") is a 7. Overall, a 6.

RUN 25-B PR: 6/6/N

Effect of turbulence was noticeable, but controlling airplane during ILS glide slope was not that much degraded over the basic case. The lateral maneuver was also a complication. The overall rating would be a 6 for ILS, visual, and overall. In this case, transition to visual was made by basically not doing anything in response to the cues and kinda letting airplane go where it would, limiting inputs, keeping them small. It just turned out that it went the right place. I didn't flare or attempt to flare much, resulting in a fairly firm touchdown. But, by good fortune, it went where I wanted it. Overall rating, a 6.

RUN 25-C PR: 6/7/N

Effect of turbulence very noticeable. Again, the heavier turbulence was compensated for by no later maneuver, but I was unable to control the rate of touchdown in the landing area adequately. I'd rate ILS glide slope a 6, touchdown a 7, and overall a 7.

DATE-RUN: 11/12/79-4 PILOT: T CONFIG: F1

RUN 4-A PR: 2/2/N

Feel forces and sensitivity seem slightly less sensitive or maybe same as baseline aircraft (Configuration AF111F). Lateral-directional remain the same. No problems in pitch response. Airspeed control had no problems. Good glide-slope acquisition, maintaining glide slope was no more difficult than basic aircraft. Pilot rating remains a 2. Visual: pitch control remains good. Slightly more stable in pitch, slightly less response. Lateral maneuver remain same as basic aircraft. The visual seemed slightly easier than ILS. Flare and touchdown remain the same, a 2, like the basic aircraft. Overall, a 2.

RUN 4-B PR: 2/2/N

No special effect of turbulence on maneuvering aircraft. Lateral maneuvering remained the same. There is more displacements in the glide slope and localizer, but control effectiveness remains the same. Pilot rating remains the same, 2.

RUN 4-C PR: 2/2/N

Effect of turbulence mainly in the displacements in the localizer and glide slope. No change in pilot rating. Remains a 2. Aircraft essentially controlled like basic aircraft.

DATE-RUN: 11/12/79-5 PILOT: T CONFIG: F6

RUN 5-A PR: 4/5/N

There is a change in pitch sensitivity. Aircraft required more stick displacement to produce a corresponding pitch change on the attitude indicator. Then it tended to over-control the amount of displacement, so the pilot compensated with a number of smaller pitch inputs to change the pitch of the aircraft. Lateral-direction remained the same. The pitch response required a greater pilot workload. No PIO tendency, at least not in the small stick deflections. I noticed a tendency toward PIO in the flare if large stick inputs were used. Special inputs: the pilot adapted by using smaller incremental stick

movements in pitch to compensate for apparent lack of stability in pitch. There is no airspeed control problem. Glide-slope acquisition was normal. Maintaining glide slope required a greater pilot workload. I'd rate ILS at a 4 because of greater pilot compensation required. Two attempts were made at visual landing. First one, I used greater pitch inputs and tended to get into a pitch over control situation. The second, I used smaller inputs, more stabilized and aircraft was easier to control. If there are large displacements made in pitch, the airplane tends to overreact. The lateral maneuvers remain same as basic aircraft. If you transition to visual landing scene with small stick inputs, the landing will remain slightly easier than the ILS. If you once exceed certain amount of pitch inputs, then the aircraft tends to overcontrol and the aircraft becomes more difficult than the ILS. Flare and touchdown appears to require slightly more nose-down portions to bring about a touchdown right at the touchdown point. The flare: you notice the increased pitch sensitivity in the flare, and once again it takes smaller stick movements to get the response you want. Overall pilot rating, I give it a 4 because of greater workload required to fly the aircraft. In turbulence I would see the possibility of degradation in rating here because of greater displacement of aircraft. Rate visual, flare and touchdown a 5.

RUN 5-B PR: 5/5/N

Turbulence caused greater deflection, or displacements, from the glide slope. The aircraft tended to pitch 2-3 degrees without appreciable change in stick input from the pilot. Made it more difficult to control the glide slope. Flare maneuvering was more difficult. Overall rating of 5. Requires considerably more pilot compensation, especially in the flare where it tends to magnify the effects of the turbulence. One possible effect in the flare that may be degrading the performance of the aircraft may be the response of the entire simulation system in the flare if there is any slight time delay in seeing the aircraft response presented visually through the model. But, all the flare maneuvers tend to be a degraded performance compared to the ILS portion of the maneuvers. Overall rating is 5.

RUN 5-C PR: 8/10/N

Turbulence had considerable effect on pitch response of the airplane. Required greater stick deflections to bring about changes. I noticed changes of 2-3 degrees in pitch did not produce any response in aircraft response. Then, with delayed action, it would produce an over-response. ILS portion where you are responding to less sensitive glide slope to be an 8. Where you get into visual scene, as well as the scene on short final, where you're seeing the more sensitive changes in the glide slope and visual scene, I consider the flare maneuver a 10. Control was lost during portions of the flare maneuver where the aircraft was making delayed pitch changes that were not controlled, even with larger stick deflections. Overall is 10.

DATE-RUN: 11/12/79-10 PILOT: T CONFIG: F1

RUN 10-A PR: 5/5/N

Pitch forces required depression (suppression?). Pitch sensitivity about the same. Airplane seemed more unstable in pitch. You have to move the stick a greater amount to get a response out of the aircraft, and then it would move correspondingly greater. Lateral-direction remained the same, was OK. The aircraft was controllable. There was not a PIO tendency. It seems like you're seeking for the amount of stick deflection that will begin to get an aircraft response. Once you get that, the aircraft tends to over-respond. But the pitch is controllable. There was no problem controlling airspeed. Glide-slope acquisition was smooth and normal, maintaining glide slope required greater pilot compensation. Rate glide slope portion a 5. The aircraft was stabilized pretty close to glide slope and localizer as the runway appeared. The pitch control, pitch sensitivity remained the same. Lateral maneuvers were normal for the basic aircraft. Visual landing appeared easier than the ILS. Consider flare and touchdown still a 5. Overall pilot rating 5.

RUN 10-B PR: 5/6/N

Turbulence accentuated lack of pitch response of aircraft. Specially noticed, just prior to breakout, where deflections of the glide slope are greater. The flare maneuver and touch down was degraded by the turbulence. Rate the flare and touchdown, requiring extensive pilot compension - but they are tolerable defficiencies-, a 6. Rate ILS a 5, flare and touchdown a 6.

RUN 10-C

Essentially the entire run, ILS portion and touchdown, rate approximately same as 10-B: 5 on ILS portion, 6 on touch down maneuver. Difference appears to be how far you're off the localizer and glide slope, and if large inputs are once made from a semi-stabilized position, they tend to be accentuated and the pilot tends to over control from that point. If you are essentially stabilized as you break out and go into the flare maneuver, you're only putting in very small inputs, small corrections, and the aircraft tends to be more controllable. It seems, if you exceed a threshold of displacements, then the aircraft becomes more uncontrollable if you try to correct for large deviations.

DATE-RUN: 11/12/79-6 PILOT: T CONFIG: F1

RUN 6-A PR: 4/4/N

Aircraft seemed less stable than basic aircraft in pitch. Required more stick movements than basic aircraft to get a pitch response - responded more than normal. Lateral-directional OK - same as basic aircraft. No PIO tendency. Air speed control, no problem. Glide-slope acquisition was normal, maintaining glide slope required greater pilot compensation. I'd rate the glide slope as a 4. Visual maneuver: pitch control required more pilot compensation. Lateral maneuver the same. It was easier than the ILS. Flare and touchdown was a 4. Overall, a 4.

RUN 6-B PR: 4

Turbulence had some effect on the displacement of the glide slope, but nothing significant. Still rate ILS portion as a 4. Flare, a 4. Lateral maneuvering remained the same as the basic aircraft. Turbulence didn't seem to be great enough to cause any significant displacement of the aircraft. Aircraft remained controllable with moderate pilot compensation throughout.

RUN 6-C PR: 5/5/N

Turbulence required greater pitch changes to compensate for the up and down drafts. Airspeed was oscillating considerably, but no more difficult to control than the basic aircraft. Overall ILS, flare and touchdown ratings are a 5 because it requires considerable pilot compensation to change the pitch attitude in response to the turbulence.

DATE-RUN: 11/12/79-7 PILOT: T CONFIG: F2

RUN 7-A PR: 6/6/N

Noted greatly increased sensitivity in pitch, lateral directional remained the same. Pitch required considerable more stick activity to seek out a point at which the elevator deflections would begin to change the pitch of the airplane. There was less pitch response to a given size of pitch input. Special inputs: began to compensate with more rapid, smaller incremental pitch changes to seek out the point at which the aircraft would begin to respond to elevator deflections. No PIO tendency. No air speed control problems. Glide-slope acquisition was normal. Maintaining glide slope required considerable pilot compensation and stick movement, and more rapid cross check to maintain glide slope. Rate glide slope as a 6. There were very objectionable deficiencies but the aircraft was controllable. You could get adequate performance if you used extensive compensation to compensate for lack of pitch stability. Pitch control on visual about same as on glide slope - no easier or harder - it was about the same as controlling on glide slope. Lateral maneuvers were same as basic airplane, no problem. Flare and touchdown rate a 6. Overall rating, a 6.

RUN 7-B PR: 8/10/N

Thing about turbulence that makes it more difficult to control than smooth air are the up and down drafts which are rapid and fairly large magnitude - even seems to be very large magnitude at moderate turbulence - but they require a change in aircraft angle of attack up to 2-3 degrees. Looks like about 800 feet a minute up or down drafts which require up to possibly 3 degrees pitch change. To do so with the rapid change in vertical up or down drafts requires a fairly rapid change in pitch and to do so with an aircraft this unstable in pitch requires a considerable amount of stick movement. The aircraft tends not to respond quick enough to vertical turbulence. This appears to me to be giving it the greatest amount of degradation as you go into turbulence. In smooth air you can expect to be flying about +1 degree all the way down the glide slope, and this should give you a 750' a minute rate of descent and you don't expect to see any other pitch attitude. If you do get off the glide slope, they are small deviations which take only small pitch changes to make changes in the rate of descent which will bring you back

to the glide slope. ILS portion definitely different from flare portion. Effect of turbulence is considerable, especially up and down drafts. No change in lateral maneuvering. But required considerable pilot compensation to keep aircraft under control in the flare maneuver. The aircraft was stabilized as it broke out and I acquired the runway visually. But halfway through the flare maneuver, the aircraft began to pitch up. I put in partial nose-down stick inputs and there was no response. Full inputs, full nose-down elevator, and aircraft response whatsoever. Aircraft became uncontrollable. So its an 8 on the ILS. It's uncontrollable, so a 10 in flare and touchdown maneuver. Overall, 10.

RUN 7-C PR: 9/10/N

Rate ILS portion a 9. Required intense pilot concentration to maintain control of the airplane. Touch down varied between 9 and 10. Almost a loss of control, but the aircraft was touched down in the first few 100 feet of runway. I avoided trying to go to the 1500' point because I felt the aircraft would not remain in control if I tried to make that kind of correction to make a spot landing in the 1000-1500 foot touchdown region. So I would have to rate the flare maneuver a 10. ILS portion, 9. Overall, a 10.

DATE-RUN: 11/12/79-8 PILOT: T CONFIG: F4

RUN 8-A PR: 4/4/N

Aircraft had greater pitch sensitivity and instability than the basic aircraft. No change in lateral-direction control. Required greater pilot compensation to maintain a desired pitch attitude. No PIO tendency. Special inputs: just were more rapid pitch changes in smaller increments than normal baseline aircraft. No problem controlling air speed. Glide-slope acquisition was OK. Maintaining glide slope required greater stick activity and more rapid cross check. Rate ILS a 4. I knew what pitch attitude would give me what rate of descent, therefore I was able to target towards them, to make desired pitch change within 1 or 2 degrees. Within 1 degree, I was able to get the kind of pitch changes I wanted. Breakout and visual maneuver: the aircraft was stabilized pretty close to glide slope and localizer so pitch control didn't require any large deviations to get back on course. Pitch control, pitch sensitivity, instabilities remain about the same. Aircraft response remained about the same through the visual system. No difference in lateral maneuvers. Visual landing was easier than the ILS portion. Flare and touch down, a 4. Overall rating, a 4.

RUN 8-B PR: 4/4/N

Turbulence did not effect the aircraft performance as much as it has in previous runs. I was able to target for given pitch attitude to compensate for the up and down drafts. Seemed to be somewhat easier than in other instabilities and other runs. Lateral maneuver remains about the same. Overall pilot rating call a 4.

RUN 8-C PR: 5/8/N

Turbulence had more effect. Greater pitch changes required to stay on glide slope. Lateral maneuvering remained pretty much like baseline aircraft. Rate the ILS portion a 5. Required considerable pilot compensation. Rate the flare and touchdown an 8. Considerable pilot compensation required for control. Aircraft appeared to encounter an updraft just in the flare maneuvering. Required considerable amount of pitch change to try to make the airplane land within the first 1500'. Rate overall a 7 because of flare and touchdown maneuver.

DATE-RUN: 11/12/79-9 PILOT: T CONFIG: FO

RUN 9-A PR: 3/3/N

Aircraft appeared to have less instabilities in pitch than previous ones. Fairly good response to pitch inputs. Lateral direction was per baseline aircraft. Required slightly more pilot inputs to maintain desired pitch attitude than baseline airplane. No PIO tendency. Slightly more stick movement of smaller increments, more rapid cross-check for controlling pitch. Airspeed control no problem, very stable. ILS glide-slope acquisition OK. Maintaining glide slope required greater, more rapid scan, more rapid stick movement. Rating for the ILS portion is 3. Visual: aircraft broke out approximately on course and glide slope. Pitch control was more stable than other runs. Lateral maneuvers were as baseline aircraft. Visual appeared to be slightly easier than ILS. Flare and touch down was 3. Overall, 3. Minimal pilot compensation required but nothing greater than that. Some mildly unpleasant deficiencies.

RUN 9-B PR: 3/3/N

Turbulence did not have any special effect. Lateral maneuvers remain the same. Rate ILS, touchdown, and overall as 3 again.

RUN 9-C PR: 3/3/N

Turbulence had greater effect on displacements from the glide slope but still rate overall glide slope and touchdown as a 3.

DATE-RUN: 11/12/79-26 PILOT: A CONFIG: AF2 (δh_{LIM} = - 7/10)

RUN 26-A PR: 2.5/2/N

Feel forces and sensitivity OK. Lateral-direction OK. Pitch response, no problems. No PIO tendencies or special inputs. Airspeed control, no problem. Glide-slope acquisition was OK. Maintaining glide slope was pretty straightforward. Noticeable good, solid stability to the pitch, almost to the extent where it took a little bit of extra help to move the performance around. Call it a 2-1/2. Visual was slightly easier than ILS. Call it a 2. Flare and touchdown was no problem. No lateral maneuvering required. Overall pilot rating a 2.

RUN 26-B PR: 3/3/N

Effect of turbulence made maintaining glide slope a little tougher. Effect of the lateral maneuver was about the same. Pilot rating a 3 for ILS, 3 for the touchdown, and 3 overall.

RUN 26-C PR: 3/3/N

Effect of heavier turbulence was about as much as overall effect of moderate turbulence and lateral maneuver. Rating is a 3 for ILS, 3 for visual, overall a 3.

DATE-RUN: 11/12/79-27 PILOT: A CONFIG: AF2 (δh_{LIM} = -5/10)

RUN 27-A PR: 2/2/N

Feel forces, sensitivity, lateral-direction all OK. Pitch response seemed very good. No PIO tendency, special inputs, or problems. Airspeed control was easy. ILS: maintaining glide slope was straightforward. No problems. Pilot rating a 2. Visual control and lateral maneuvering were essentially the same. Flare and touchdown a 2. Overall, a 2.

RUN 27-B PR: 3/3/N

Effect of turbulence was noticeable. Lateral maneuver not particularly difficult. Appeared to be a sudden drop or downdraft on short final which made touching down where I wanted to, a little trickier. ILS portion is a 3. Visual, a 3. Overall a 3.

RUN 27-C PR: 3/3/N

Effect of turbulence was again noticeable and required some amount of work to go around with it. The timing of the vertical gusts was such that there was no problem on short final. It occurred earlier and was taken care of. Rating for ILS, the visual and the overall is a 3,3 and 3.

DATE-RUN: 11/12/79-28 PILOT: A CONFIG: AF2 (δh_{LIM} = -3/15)

RUN 28-A PR: 3/3/N

Forces, sensitivity, OK. Lateral-direction all OK. Pitch response remains essentially the same. Airspeed control, no particular problem. Glide-slope acquisition was OK. Maintaining glide slope for some reason seemed a little more difficult than the previous run, but it may have been me. Rate a 3. Visual essentially the same, rate a 3. Overall, 3.

RUN 28-B PR: 3/4/N

Effect of turbulence was noticeable but, maintaining glide slope, the basic task remained essentially the same. Glide-slope portion a 3. Effect of lateral maneuver complicated the situation slightly and it appeared we had a fairly healthy downdraft on short final again. This caused a requirement for some larger pitch inputs and power inputs, and it was about that point that I first saw a tendency toward instability developing and very strong PIO tendency beginning to develop just before touchdown. Aircraft seemed to go low. Trying to check it caused it to pitch up more than I wanted. Then when I tried to put it back, it nosed over and appeared to hit fairly hard. ILS glide-slope portion remains a 3. Visual, probably a 4. Overall, a 4.

RUN 28-C PR: 5/5/N

Effect of turbulence much more noticeable now on problems in pitch. When larger pitch inputs are required, there is a definite lack of response to the aircraft. As long as the pitch inputs are small it

seems to respond satisfactorily. But when requirement for larger inputs is there, there is a definite lack of response to the aircraft requiring considerable amount of attention. The ILS glide slope is a 5. Flare and touchdown is a 5, and overall a 5.

DATE-RUN: 11/12/79-29 PILOT: A CONFIG: AF2 (δh_{LIM} = -10/+10)

RUN 29-A PR: 3/3/N

Forces, sensitivity, lateral-direction OK. Pitch response no problems. No PIO tendency or special inputs required. Except airplane has a perhaps slight resistance to going crisply where you want it. But it seems to be a good stable airplane. Glide-slope acquisition -- maintaining glide slope, a 3. In visual, a lateral maneuver was required particularly, and it seemed to be if anything easier than the ILS. Flare and touchdown a 3. Overall a 3.

RUN 29-B PR: 3/3/N

Effect of turbulence was noticeable but aircraft seemed to respond fine to necessary pitch inputs, which could be made with either large input or quick pulse and aircraft seemed to respond quickly and accurately to them. Performance followed making maintaining glide slope a reasonable task under circumstances of moderate turbulence. Lateral maneuver presented no real problems. Pilot rating remains a 3 across the board.

RUN 29-C PR: 3/3/N

Effect of turbulence was very noticeable. Again, the pitch control and ability to control the airplane and counter the gusts in the drafts was actually quite good. ILS portion remains a 3. Visual, touchdown a 3. Overall a 3.

DATE-RUN: 11/12/79-30 PILOT: A CONFIG: AF2(δh_{LIM} = -10/5)

RUN 30-A PR: 4/4/N

Feel forces, sensitivity, lateral-direction all OK. Pitch response: noticeable difference in pitch response. Best described as lack of response to pitch inputs. As long as inputs were very, very small it seemed normal, but with any magnitude it seemed the aircraft had a resistance to responding. Not like over stability, but like lack of control. Airspeed control presented no real problem. But glide-slope acquisition and maintaining glide slope was noticeably more difficult than previous cases. It would have to be a 4. No lateral maneuvers were required in the visual, but the difference was about the same. Flare and touchdown remain 4, with a very definite tendency to exhibit control problems if you are not careful about staying ahead of it. Visual touchdown is a 4 and overall is a 4.

RUN 30-B PR: 4/4/N

Effects of turbulence was noticeable, but did not seem to make the aircraft that much more difficult to fly than the no turbulence case. I can't tell if I was just working harder or what, but the tendency to not have quite enough control in the no turbulence case did not seem to cause

any additional difficulty in the moderate turbulence case or with the lateral maneuver. Pilot rating remains a 4 overall.

RUN 30-C PR: 5/6/N

Effect of turbulence was much more noticeable. Occasionally there were some very definite situations where not just the control inputs but the pitch inputs failed to give the desired performance. Airspeed was somewhat more difficult to maintain. On final portion of the approach and flare there were a couple occasions where limit stick movements were insufficient to counter the pitch tendency, but we got it back OK. Rating would be 5 for ILS portion, a 6 for the touchdown, 5-1/2 overall.

DATE-RUN: 11/14/79-12 PILOT: T CONFIG: AF0

RUN 12-A PR: 2/2/N

Feel forces remain the same (as basic aircraft). Pitch sensitivity was greater this time. But there is no overshoot tendency for changes in pitch inputs from the stick. The aircraft responds quicker than the basic aircraft in pitch changes, but there's no overshoot -- come up or down to the new pitch attitude and stay there once the stick is neutralized. Lateral-direction OK, same as basic aircraft. Pitch response no problem. No PIO tendency. No special inputs. In fact, it was a little more pleasant having a little more rapid pitch response, at least in this case with no turbulence there was no problem. No problem with airspeed control. Glide-slope acquisition was normal. Maintaining glide slope seemed to be slightly easier because of more rapid pitch response. Pilot rating overall 2. Visual maneuver, pitch control, no overshoot tendency. Good response to pitch inputs. Lateral maneuvers same as basic aircraft. Visual seemed a little easier than ILS approach. Flare and touchdown is a 2. Overall 2 for the aircraft.

RUN 12-B PR: 2/2/N

Turbulence did not affect the handling characteristics of the aircraft. As for the displacements from the glide slope caused by turbulence, the aircraft responded more quickly in the pitch, was a little easier to control. There was no overshoot in pitch tendency. The pitch could be changed to the new desired pitch angle without any overshoot or any difficulty. Lateral maneuvers remain the same. This pilot particularly likes an aircraft slightly more sensitive pitch than the basic F-111, so I'm going to rate pitch characteristics a 1. Overall characteristics, including lateral maneuver, as 2.

RUN 12-C PR: 2/2/N

Turbulence seemed to upset the pitch a little easier than the basic aircraft, but due to the more rapid pitch response, the airplane, in a positive pitch response, was more controllable than the basic aircraft in pitch. Lateral maneuvers remain the same. Overall pilot rating for the approach and visual landing is a 2.

DATE-RUN: 11/14/79-13 PILOT: T CONFIG: AF2

RUN 13-A PR: 2/2/N

Feel forces normal as for the basic aircraft. Pitch and roll sensitivity were same as basic aircraft. Pitch response, no problem. No

PIO tendency. No special inputs required. Air speed control was the same as basic aircraft. Glide-slope acquisition, maintenance of glide slope same as basic, rating of 2. Visual landing: pitch control same as basic aircraft. Lateral maneuvering the same. Slightly easier than the ILS overall. Flare and touchdown, 2. Overall rating a 2. Very close to basic aircraft handling characteristics.

RUN 13-B PR: 2/2/N

Turbulence had no special effect on handling characteristics of airplane. Lateral maneuver was the same as basic airplane. Overall rating of 2. Flew very similar to basic airplane.

RUN 13-C PR: 2/2/N

No effect of turbulence on handling characteristics. Just greater displacements on the localizer and glide slope. Pilot rating: no change, a 2.

DATE-RUN: 11/14/79-14 PILOT: T CONFIG: F1

RUN 14-A PR: 4/4/N

Feel forces remain the same. Pitch sensitivity was different because small input would produce a greater pitch change. Say, if you want to go from 0 to 5 degrees pitch attitude, you put in a corresponding amount of stick deflection as you would for basic aircraft, but the pitch would overshoot and you would have to make an opposite pitch movement on the stick to stop the pitch from overshooting the target pitch that you want. Lateral-direction remains the same. This is the main problem with the pitch. There is no PIO tendency. So the special inputs were the opposite pitch input that you have to make to stop the pitch from going beyond the target pitch that you want. No problems with airspeed control. Glide-slope acquisition was a little more difficult because of the greater pitch activity required. Same thing in maintaining the glide slope. Pilot rating of 4 on ILS because it does warrant improvement. They are minor but annoying deficiencies that can be compensated for by the pilot. The mission can be accomplished to a desired level of performance. The visual maneuver: pitch control about same as on the glide slope. Lateral maneuvers were same as basic aircraft. Visual equal difficulty as maintaining glide slope. Flare and touchdown, give a pilot rating of 4. Overall, 4.

RUN 14-B PR: 4/5/N

Turbulence did not affect the handling characteristics of aircraft. But ILS portion rating still 4. Once the visual presentation was acquired, the aircraft performance required considerable pilot compensation in the presence of the turbulence to make the aircraft pitch to where I wanted it go. The aircraft tended to overshoot and it took considerable amount of stick movement, which I stair-stepped up, to try to bring the pitch attitude back to what I wanted. So the landing and the visual in landing maneuver was a 5. Overall a 5.

RUN 14-C PR: 4/5/N

Remained about the same as 14-B. No special effect of turbulence on handling characteristics. Pilot rating for ILS is 4, flare and touchdown, a 5. Overall rating a 5.

DATE-RUN: 11/14/79-15 PILOT:T CONFIG: F4

RUN 15-A PR: 5/6/N

Inbound portion, feel forces same as basic aircraft but sensitivity seemed to be greater than run 14. Aircraft seemed to change pitch attitude a greater amount for the same amount of stick input than it did on 14. Lateral-directional control is essentially same as basic airplane. There is a greater tendency for PIO with this run. Special inputs required little more rapid cross-check and little more small incremental movements of the stick to get the desired pitch. Airspeed was no problem. Glide-slope acquisition was what you would expect for this lessened pitch stability. Maintaining glide slope required greater stick movement and greater cross-check of glide slope than basic aircraft. ILS portion I'd rate as 5, because it required considerable amount of pilot compensation to maintain glide slope. Visual maneuver: pitch control was more difficult than on ILS, I think because you can see pitch changes more dramatically when you are on visual than when on ILS. As apposed to seeing just a small change on the attitude indicator, now you can see the whole change in the perspective of the runway when you make a pitch change. So the pilot has a tendency to overcontrol when he sees a pitch change, which makes pitch control more difficult. So visual was more difficult than ILS portion. Lateral maneuvers same as basic aircraft. Flare and touchdown rate a 6 because requires extensive pilot compensation. It is very objectionable, but from this run here, it appears that it can be done. You can get adequate performance. You can get a landing out of it, but it requires an extensive amount of compensation. Overall rating, a 6 because of the flare and touchdown.

RUN 15-B PR: 6/7/N

Turbulence did not seem to change the handling characteristics of the plane. Response to greater deflections from glide slope and localizer required greater pitch changes which were more difficult because of lessened pitch stability of the airplane. ILS portion a 6. Very objectionable, with extensive compensation you get barely adequate performance. Flare maneuver and touchdown rate as a 7 because, controllability is not in question, but I don't consider it adequate performance even with maximum pilot compensation. Overall a 7.

RUN 15-C PR: 7/9/N

Aircraft, give rating of 7 on ILS. Don't consider performance adequate. It was controllable. However, in flare and touchdown the pitch movements of the airplane were more apparent. Took intense pilot compensation to retain pitch control. Just prior to touchdown, the aircraft required nose down pitch. I put in that pitch and held it, and the airplane just barely responded to it at the last seconds. Give 7 on ILS. 9 for flare and touchdown. Overall 9.

DATE-RUN: 11/4/79-16 PILOT: T CONFIG: FO

RUN 16-A PR: 4/4/N

Inbound portion, sensitivity was slightly greater than the basic aircraft. Slightly greater tendency for pitch overshoot than the basic airplane. No PIO tendency, though. Special inputs: slightly more correction required to stop the pitch attitude once a change has been initiated. Airspeed control no problem. Maintaining glide slope required more stick inputs to keep the pitch attitude where I wanted it than with the basic airplane. Rate ILS 4. Visual seemed about the same in difficulty as ILS portion. Lateral maneuvers remained the same as the basic airplane. Flare and touchdown rate a 4. I can attain the desired performance. There are just minor but annoying deficiencies. They should be improved. Overall a 4.

RUN 16-B PR: 4/4/N

No special effects of turbulence on pitch or lateral maneuvers. I'd maintain same pilot rating of 4 for ILS and the flare and touchdown.

RUN 16-C PR: 5/5/N

ILS portion required considerable amount of pilot compensation to maintain glide slope and localizer. Flare and touchdown portion also required considerable pilot compensation. Rate 5 both glide slope and flare and touchdown. One factor to consider here is the adaptation of the pilot to these instability conditions and the improvement of this ability to anticipate them. Still, I would rate as 5 overall.

DATE-RUN: 11/14/79-17 PILOT: T CONFIG: F6

RUN 17-A PR: 5/5/N

Inbound, aircraft is less stable than basic aircraft in pitch. Seem to be greater changes in pitch attitudes for small stick deflections than other runs. Lateral-direction, same as basic airplane. PIO tendency was not too great if the pilot used small stick inputs to stop the pitch where he wanted it. It takes more small pitch inputs to make a change than the basic airplane. No problem with airspeed control. Glide-slope acquisition and maintaining the glide slope required more stick activity. ILS portion 5. Required considerable amount of pilot compensation to keep pitch attitude where you want it. Visual maneuver: pitch control same as the ILS portion. Visual about as difficult as ILS, trying to maintain the pitch where I wanted it. Flare and touchdown rate a 5 also. Overall a 5.

RUN 17-B PR: 5/5/N

Rate 5 overall, 5 on ILS, and 5 on flare and touchdown. Requires considerable pilot compensation to maintain glide slope. Flare and touchdown maneuver: takes considerable amount of stick movement to stair-step up or down the pitch to where you want it to make the landing throughout the flair and touchdown maneuver. 5 overall.

RUN 17-C PR: 5/6/N

Rate ILS a 5. Still requires considerable pilot compensation. Flare and touchdown a 6. With the heavy turbulence, requires extensive

amount of compensation, but you still get the airplane on the ground in adequate fashion. Overall a 6.

DATE-RUN: 11/14/79-18 PILOT: T CONFIG: F?

RUN 18-A PR: 6/6/N

Inbound, pitch very sensitive. Large pitch excursions for small stick inputs. Lateral directional OK, same as basic airplane. Airplane definitely has a tendency for PIO if the pilot gets out of sequence with it. Special inputs was just getting used to the amount of stick corrections necessary to stop the pitch attitude where you want it, doing it fast enough, and being able to anticipate what the pitch is going to do and doing it quickly enough. No problem with airspeed control. Glide-slope acquisition is what you would expect for this kind of pitch instability. Maintaining glide slope: required extensive amount of pilot compensation to maintain glide slope. Rate ILS a 6. Pitch control in visual about same as ILS. Lateral maneuvers about same as basic aircraft. Visual about the same in difficulty as ILS portion. Flare and touchdown rate a 6 because I was able to get adequate control of the aircraft to make an adequate landing with this type of pitch instability. Rate whole run 6 overall.

RUN 18-B PR: 6/6/N

Turbulence caused greater displacements on the glide slope. ILS rate a 6. Required extensive pilot compensation but I was able to perform ILS adequately. Flare and touchdown a 6 also.

RUN 18-C PR: 6/10/N

ILS portion still a 6. Got adequate performance with extensive pitch compensations for the instability. The visual portion: during initial breakout, I controlled the aircraft adequately. As I got into the flare, apparently got a strong updraft just prior to touchdown, and I went forward on the stick and finally had to go to a full forward stop, and hold it there, with no pitch response from the airplane so I was momentarily out of control during the touchdown maneuver. Have to rate flare and touchdown a 10 and overall a 10.

DATE-RUN: 11/14/79-19 PILOT:T CONFIG: AF2

RUN 19-A PR: 2/2/N

Inbound portion, aircraft was slightly more responsive in pitch sensitivity than basic aircraft. However, there is no overshoot like in previous instabilities. Lateral-direction OK, same as basic. No problem with pitch. No PIO tendency. No special inputs. Airplane responded quickly to very small stick inputs, changed pitch attitude and stayed there. No airspeed control (problem). Very good glide-slope acquisition, maintaining glide slope slightly easier than basic airplane because of more responsive pitch. Pilot rating for ILS is an overall 2. However, I like pitch little better than basic airplane. Visual: pitch control excellent, lateral maneuvers good, visual portion seemed a little easier than ILS portion. Flare and touchdown, overall 2. I do like the extra pitch responsiveness that this apparently has over the basic airplane.

RUN 19-B PR: 2/2/N

Effect of turbulence, nothing special in handling characteristics. Pitch responsiveness remains the same. No effect on lateral maneuver. Rate ILS overall 2. Flare and touchdown maneuver, 2. Overall, 2.

RUN 19-C PR: 2/2/N

Rate ILS as a 2 overall. Flare and touchdown is a 2. Apparently encountered some significant updrafts, up and down drafts, during short-final portion of flare and touchdown. Aircraft responded OK in pitch. Rate it overall 2.

DATE-RUN: 11/14/79-34 PILOT: A CONFIG: AF2

RUN 34-A PR: 2/2/N

Feel forces, sensitivity, lateral-direction all OK. Pitch response no problem. Seemed to be just slightest overshoot tendency, given pitch input. Pitch would tend to drift just a little past where you put it. No PIO tendency. Vertical speed, or desired performance of airplane changed much quicker with pitch changes than previous case, making actual handling of aircraft for maintaining glide slope much better. Glide slope acquisition and maintaining glide slope a 2. Visual control: lateral maneuvering may be slightly more difficult than ILS. Flare and touchdown pretty much what you want, call it a 2. Overall a 2.

RUN 34-B PR: 2.5/3/N

Effect of turbulence noticeable. Required a lot more attention to maintain glide slope. Aircraft seemed to respond well to inputs making ILS portion a 2-1/2. Visual was slightly more difficult, not so sure why, but would call visual, flare and touchdown a 3. Overall, 2-1/2.

RUN 34-C PR: 2.5/2.5/N

Effect of turbulence noticeable. Ability of airplane to plow through it and maintain desired glide slope was excellent in spite of it. Visual this time seemed no more difficult than the other, perhaps because there was no lateral maneuvering required. Call it a 2-1/2 for ILS, 2-1/2 for touchdown, 2-1/2 overall.

DATE-RUN: 11/14/79-35 PILOT:A CONFIG: AFO

RUN 35-A PR: 2/2.5/N

Forces, sensitity, lateral-directional all OK. Pitch response no problem. Slight bounciness to pitch response from input, very subtle. No PIO tendency or special inputs required except for a little more attention to make sure pitch stays where you put it. Airspeed control no problem. Glide-slope acquisition and maintaining glide slope were very easy. Call it a 2. Visual, pitch control, lateral maneuvers, difference from ILS about same. Flare and touchdown slight tendency to overshoot pitch attitude, but not a problem, but I'll call it a 2-1/2. Overall 2-1/2.

RUN 35-B PR: 2.5/2.5/N

Effect of turbulence was noticed. But aircraft response, as far as performance response, the vertical speed changes, seemed very easy to make in spite of slight pitch bounciness. Maintaining glide slope was still not very difficult, about 2-1/2. Flare and touchdown was no more difficult this time than without turbulence, also 2-1/2. And 2-1/2 overall. The moderate turbulence or lateral maneuver seemed to make very little difference in ability to control the airplane.

RUN 35-C PR: 3/3/N

Effect of turbulence more noticeable this time with the severe turbulence case. Again flying through it was no real problem. Flare-touchdown portion was OK, with the exception that in this particular run, we seemed to pick up some unrealistic ground effect that I will discount as perhaps a questionable area of the simualtion. Airplane responded well in spite of heavy turbulence. I could put it pretty much where I wanted it. ILS glide slope portion is a 3, flare and touchdown a 3, overall a 3. Perhaps the reason for the 3, rather than the 2-1/2 as previous, is some of the sponginess and strange little occurrences that became more noticeable this time than prior and made it slightly more difficult to put the airplane where I wanted it.

DATE-RUN: 4/18/80-50 PILOT: R CONFIG: AFO

RUN 50-A PR: 2/2/N

The feel characteristics are good, forces are fine, sensitivity seems OK in both pitch and roll. Directional characteristics are all OK. Didn't notice any particular problems on the pitch response other than this very small tendency to pitch up now when the computer is turned on, but I can trim that out quite easily. Airspeed control is very good. Able to acquire the glide slope and maintain glide slope with no difficulty. The last maybe 200-300 feet before breaking out, the sensitivity is just a little bit high maintaining glide slope, but it presents no problem control-wise. I would rate it at a 2. Under visual conditions I didn't notice anything different at all. It was very easy to line up on the center line, and pretty much touchdown in the area of the runway that I think would be normal touchdown point. The pilot's rating on touchdown I would also leave at 2. And the overall rating is at 2. It is a good airplane and don't see any real big problems with it.

RUN 50-B PR: 2.5/2.5/N

With some turbulence, looked very good. No particular problems with the lateral-directional, feel or the forces. The glide slope was relatively easy to acquire and I would put it at a 2-1/2 for the ILS. The visual conditions were also satisfactory. We had a breakout, off to the right side of the runway, which was easy to correct for and I would say that the flare and touchdown were satisfactory. I would give the overall rating at a 2-1/2. There was not a lot of affect due to turbulence but I would say that it probably extended the touchdown point slightly. But airspeed control seemed to be good in turbulence and didn't create any real problems.

RUN 50-C PR: 2.5/2.5/N

Was satisfactory. I couldn't tell any difference really between 50-B and 50-C, and I would leave the pilot rating at 2-1/2. Did end up down the runway just a little past the normal touchdown point but it was not excessive and the airplane responded well to thrust inputs as well as lateral-directional and pitch, so still pretty good airplane even in these different turbulence levels.

DATE-RUN: 4/18/80-51 PILOT: R CONFIG: AF111-G

RUN 51-A PR: 2.5/2.5/N

Was completed satisfactorily. Feel and both lateral-directional and pitch seemed to be OK. No porpoising tendencies or any particular problems noticed. Airspeed control seemed to be just a little slow in responding to reduction in thrust. In other words, I was on the idle stop waiting for my speed to come down, but it wasn't too bad. I was able to correct it without waiting too long. The ability to acquire the glide slope and maintain the glide slope was good. I would say there is something about the system though that gave me the impression that it wasn't as good as the previous one, so I am going to give it a 2-1/2. Visually, I noticed I ran a little further down, a little harder to get it down to the runway, but it still was not difficult. And I would say that in the flare and touchdown the overall rating would be 2-1/2.

RUN 51-B PR: 2.5/2.5/N

With some turbulence, was again a good configuration. No particular problems with it. I think I would probably stay at a 2-1/2 with it. I didn't see any additional problems associated with turbulence. Seemed to be satisfactory. I would go both IFR and VFR with a 2-1/2. Have good control of the airplane and although I am not using a lot of throttle, the response seems to be adequate -- normal.

RUN 51-C PR: 3/3/N

Was a little more difficult to handle, but it still worked out satisfactorily, and I am going to go to a 3 on pilot ratings for it. Again, I didn't see any big difference between visual and IFR. The touchdown seemed to be reasonable considering the turbulence and airspeed control seems to be reasonable. There is a tendency for airspeed, when it gets a little bit high, like 10 knots over reference speed, it's a little hard sometimes to bleed it off. But it is working satisfactorily and I would leave it to an overall 3.

DATE-RUN: 4/18/80-52 PILOT: R CONFIG: AFO

RUN 52-A PR: 2.5/2.5/N

Was very satisfactory. No problem with the feel or lateral-directional. Pitch response looked good. We did make a change to drag on that configuration. The drag was increased over what we had flown on 50 and 51 configurations. And I think that airspeed control was probably a little easier to handle. I would say that the pilot rating on the ILS was a 2-1/2. No particular problems in maintaining glide slope or acquiring or anything like that. Visual looked reasonable to me. No tendency for oscillations or porpoising and over-controlling at all. The

pilot's rating during the flare and touchdown I would also leave at 2-1/2, giving it an overall 2-1/2 rating.

RUN 52-B PR: 3/3/N

With some turbulence, was satisfactory. Again, no over-controlling of any kind on either pitch or lateral directional. I am going to give it a 3. We ended up flaring a little big long on the touchdown, but had a good control of speed and I didn't see any difference between the VFR and the IFR portion of the flying. An overall 3.

RUN 52-C PR: 3/3/N

With just a little more turbulence. I wouldn't change the pilot rating. I think I will leave it at a 3. I didn't see anything particularly different between the B and C runs. It was still easy to control. No tendency for porpoising, over-controlling. Airspeed control is very satisfactory.

TEST ENGINEER'S NOTE:

The drag increased (C_{D_1}, from .241 to .341) on this run to reflect the open landing gear doors which apparently had been left out of the drag build-up. All F configurations from here on had the larger (.341) value. The effect was to give more deceleration at idle power in the final approach, flare, and touchdown phases, thus reducing the floating tendency. All calculated characteristics for the F configurations use the larger value of C_{D_1}.

DATE-RUN: 4/18/80-53 PILOT: R CONFIG: AF2

RUN 53-A PR: 2/2/N

Was very good configuration. I am going to go back to a 2 on it. No particular problems with the feel or lateral-directional. Pitch response was good. Air speed control is good. Noticed no problems in acquiring the glide slope or maintaining, and the visual was very satisfactory. The touchdown point was possibly a little big long but nothing unusual about it. An overall 2.

RUN 53-B PR: 2.5/2.5/N

In moderate turbulence. Turbulence had very little effect on it. Nothing particularly different. Didn't have any over-controlling tendencies. I will give a 2-1/2 on the overall rating but can't say that it changed anything much. I did notice that it landed just a little bit short on that one from where I was planning to touchdown. I wouldn't expect that to be a big deal in terms of the turbulence. I did have good control of the airplane.

RUN 53-C PR: 2.5/2.5/N

With heavy turbulence still didn't give any problem. I would leave the rating at 2-1/2. I couldn't see any effect on that turbulence. We ended up landing a little bit long on that last one, but again we were a little high when we broke out visual. No over-controlling tendencies were observed at all. It looked good.

DATE-RUN: 4/18/80-54 PILOT: R CONFIG: F1

RUN 54-A PR: 6/8/N

Was a failure. We had a red light at the start of the run. However, there was no turbulence. I found that the airplane was quite sluggish in pitch. Sensitivity was low. Lateral-directional seemed to be OK, but the pitch response was bad. It looked to me like a divergent airplane; in other words, an airplane that was a fairly aft CG and it required full attention on the pitch. Airspeed control was not that big a problem as far as IFR flying was concerned where I made by corrections rather small. I was able to maintain reasonably close to the glide slope; however, I did get high on the first breakout and ended up not being able to land because of it. Under visual conditions I found it was more difficult to control. I was using bigger inputs and I never was able, in two runs, to get it down to where I would say it was acceptable from a landing standpoint. I am going to give it about a 6 on the IFR portion of the approach. Acquiring a glide slope and all was not that bad in smooth air. However, flare and touchdown, I would probably put it at about an 8. The first two were go-arounds, and I am sure I had enough control to handle that.

RUN 54-B PR: 7/8/N

On the run with turbulence, 54-B, a lot of turbulence, I was able to handle it without any trouble on the landing. In other words, I had not gotten into any big corrections so I was able to hold it from diverging and made an acceptable landing. But I would probably say the overall airplane is at least a 7, a 7 or an 8, with the landing VFR portion being 8, and the IFR portion being a 7 in turbulence. The smooth air portion I would give it a 6 in IFR, and in VFR I would have to go back to an 8 on the configuration. We did not run a heavy turbulent condition.

RUN 54-C (was not run)

DATE-RUN: 4/19/80-55 PILOT: R CONFIG: AFO

RUN 55-A PR: 2/2/N

Was just completed with no particular problems. The flight controls feel OK. Sensitivity, forces are good in both pitch and lateral-directional. No tendencies for porpoising or over-controlling at all. Airspeed control is good. Maintain the glide slope without any real difficulty, and I would rate it a 2. I didn't see anything show up when we broke out, visually, that was different from what we have seen. I would say that the flare and touchdown is also a 2, and the overall rating is a 2. It is a good configuration.

RUN 55-B PR: 2.5/2.5/N

With moderate turbulence, worked out very well. No particular problems with it. The difference between the VFR and IFR portions of it were negligible. I would put it at 2-1/2. The touchdown and the landing portions of it were satisfactory. However, the sink-rate might have been a little on the high side, but it wasn't bad from where I saw it. Overall, 2-1/2.

RUN 55-C PR: 2.5/2.5/N

The first run of 55-C with heavy turbulence resulted in getting high on the glide slope. About the time I broke out, it was obviously too high for the landing, so, initiated a go-around. No particular problems with it. Just let it get high. The repeat of 55-C with heavy turbulence resulted in a satisfactory approach and landing. I would give it a 2-1/2. I couldn't say there was much difference between the moderate and heavy turbulence. Work load might be slightly higher but it is still a very satisfactory configuration. No particular problems showing up as far as the control is concerned. Overall 2-1/2.

DATE-RUN: 4/19/80-56 PILOT: R CONFIG: AF2

RUN 56-A PR: 2/2/N

Was very satisfactory. I would put it at 2. No problems in either pitch or roll. No tendency for over-controlling at all and speed control was good. Acquisition of the glide slope was very good. I would put it at a 2. Visual was good. No problems with it on flare and touchdown. There was some indication that maybe the flare didn't get completely down to the runway, because we did not receive an indication of wheel touchdown on the audio, but it looked reasonably good to me. I would give it an overall 2. (Note: wheel touchdown audio didn't operate on this run).

RUN 56-B PR: 3/5/N

Run with moderate turbulence. The IFR portion of it was satisfactory. Could maintain reasonably close alignment with the glide slope. No particular control problems, but as soon as we broke out visually I noticed that the pitch response was quite sluggish and I had a little bit of trouble over-controlling slightly to get the proper touchdown sink-rate. The touchdown and all seemed to work out OK, but I was working hard to accomplish it because of a rather low sensitivity in pitch. It was not noticeable until we were under visual conditions. I would go to about a 5 on the pitch under visual conditions. I would leave it at about a 3 under IFR conditions in this moderate turbulence. The overall rating is about a 4.

RUN 56-C PR: 4/5/N

With heavy turbulence the ability to hold the glide slope was a little less precise under this condition. I was able to stay reasonably close to it, but I noticed my work load was up and the response to stick input isn't quite as good as I have seen on some of the other configurations on IFR. I would rate this one at about a 4 for IFR, and I would stay at a 5 at VFR conditions where I am putting in larger control inputs. I was not quite as conscious of the over-controlling or the sluggishness of the system this time, but the most noticable difference is what I would call a lower sensitivity in pitch. Turbulence seems to aggravate it somewhat, but it is most noticable under VFR conditions. The overall rating on it is a 4.

DATE-RUN: 4/19/80-57 PILOT: R CONFIG: F1 (δh_{LIM} = -25/15)

RUN 57-A PR: 4/5/N

Conducted with a failure. The airplane felt as if it were divergent in pitch. Very low damping. However, it was controllable and particularly with small inputs. There was a definite PIO tendency as the inputs became larger and they were most noticeable during VFR flying. The first approach resulted in having to go around after breaking out. I was unable to correct a slightly low condition without a large input that resulted in a fairly high flare and not being able to get back to the runway for a landing. The second attempt was satisfactory with making rather small inputs and the landing did not present itself as a problem in smooth air. I would give the airplane about a 4 rating on the instrument portion or the IFR portion of the ILS. I would go to a 6 on the visual portion. Probably go to an overall rating of a 5. Airspeed control was more difficult under VFR conditions because of larger inputs, but wasn't any major problem I would say. The main problem is a low damped condition in pitch; almost appears as if it is divergent in static longitudinal stability.

RUN 57-B PR: 5/6/N

With moderate turbulence, resulted in about a 5 airplane relative to the IFR portion of it. I would go about 5-1/2 on the VFR portion. It looked like making larger inputs is what stirs up the problem. Airspeed control was OK. I looked like I was a little firm on the landing. I would go about a 6-1/2 on VFR. 5 on the IFR portion. Probably an overall 5-1/2.

RUN 57-C PR: 6/7/N

Was with heavy turbulence. I had a little more trouble with airspeed control this time, and under IFR conditions it seemed like I was working a little harder at it. However, I could reasonably hold the glide slope. I had a little trouble with the first run because of maintaining a localizer sufficiently to make a reasonable approach when I broke out. And we did have to go around on the first run. The second run resulted in a satisfactory landing. However, again under VFR conditions the airplane is quite touchy. I shouldn't say quite touchy, it is sluggish and larger inputs result in fairly large excursions in pitch which make it difficult to get a decent sink-rate on landing. Under these conditions I would give it a 6 for IFR and a 7 for VFR conditions. The critical thing being again the sluggishness in pitch; appears to be aft CG condition, undamped longitudinal inputs. I would make it a 7 overall for this level of turbulence.

DATE-RUN: 4/19/80-58 PILOT: R CONFIG: F1 (δh_{LIM} = -25/20)

RUN 58-A PR: 5/5.5/N

Was conducted with no turbulence. The longitudinal characteristics are similar to what we had before. Maybe not quite as severe. There is a definite tendency to show a divergent characteristic in pitch. No PIO tendencies noticed. But inputs made and let go, it will continue to pitch in one direction or the other. Again reminds me of aft CG characteristics. By making small inputs, airspeed control and glide

slope control is satisfactory. I would probably put the IFR portion of it at about a 5. And the VFR portion of it at about a 5-1/2. The flare and touchdown worked out all right, but again it is a matter of forcing yourself to make small inputs. The overall rating I would go for a 5.

RUN 58-B PR: 5.5/6/N

Was with moderate turbulence. The IFR portion of it was again a little more satisfactory than the VFR. I would go about a 5 1/2 on the IFR and a 6 on the VFR. No particular problems. The airplane is still divergent. I don't really know whether it was caused by a failure in the system or just what. The airplane is quite touchy. When it comes to making large inputs, I can over-control it quite easily. I would give it an overall rating of 5-1/2.

RUN 58-C PR: 5.5/5.5/N

Was with heavier turbulence. I get the impression that the airplane is not so much divergent, I guess, as just low in damping, quite low in sensitivity. In this turbulence condition I would leave it at about the same. I would leave it at about an overall 5-1/2. I didn't seem to have any particular problems with it, but it is not as easy to put down on the runway as smoothly as I'd like and I think it is just due to sluggish feeling in the logitudinal control system that accounts for it.

DATE-RUN: 4/19/80-59 PILOT: R CONFIG: F4

RUN 59-A PR: 6/6/N

Was conducted with a failure in the longitudinal control system. The air was smooth. I noticed that the airplane was divergent in pitch. However, it was not difficult to damp out, pitch up or pitch down, depending on which way it is going. Airspeed control was not much of a problem with the small inputs that we were making particularly on the IFR portion of it. I didn't have any trouble staying on the glide slope either IFR or VFR. I would probably put the airplane at about a 6 right now, on both IFR and VFR, mostly because of the divergent pitch characteristics. Flare and touchdown seemed to work out all right. I noticed no particular problems. It looked like it was a reasonable sink-rate at touchdown.

RUN 59-B PR: 6.5/7.5/N

Was again with an augmentation failure in moderate turbulence. I would put it at about a 6 1/2 on the IFR portion of it, but I would go to at least a 7 1/2 on the VFR. Again it is quite easy to get into large excursions in pitch when larger inputs are made, and very difficult to judge altitude excursions or check the sink-rate close to the runway. Overall 7.

RUN 59-C PR: 6.5/8/N

Was with heavy turbulence and longitudinal augmentation failure. I would still leave it at about a 6 1/2 with the IFR portion of it. The workload is higher, but it can be flown reasonably close on the glide slope. I ended up breaking out a little bit high, and I had to force the airplane down after I got VFR with a bigger input which resulted in a large control input. Actually, did feel like I might have bottomed the

column a couple of times during the maneuvers under VFR conditions. The touchdown did not look good to me at all. I would probably go to at least an 8 on the configuration. Overall configuration a 7. It would be an 8 under VFR and total 7. On the last run, it probably would have been a better idea to have gone around than to have completed the landing the way I did just because we were a little bit high and the sink-rate was not really control. But we did get it down on the runway in a reasonable distance from the end.

DATE-RUN: 4/19/80-50 PILOT: A CONFIG: AFO

RUN 50-A PR: 2/2/N

Forces and sensitivity were OK. Lateral-directional OK. Pitch response is very good - no problem. No PIO tendency or special inputs. Airspeed control was fine. Glide slope and acquisition and maintaining glide slope were no problem. We'll call it a 2 for the ILS. Pitch control on the visual was also no problem. Lateral manuvers essentially were not required, and it was approximately the same as the ILS. I tended to go just slightly low which was my own doing. Flare-touchdown we'll also call a 2, and overall a 2

RUN 50-B PR: 2/2/N

Effect of turbulence was, in lateral, noticeable and made a little more of a workload, but the airplane pretty much went where I wanted it to and it remains a 2.

RUN 50-C PR: 3/3/N

The effect of heavy turbulence made it a lot harder to fly the airplane and the rating will be a 3 for both the ILS and the flare touchdown.

DATE-RUN: 4/19/80-51 PILOT: A CONFIG: AF111-G

RUN 51-A PR: 2/2/N

Forces and sensitivity are OK. Lateral-directional is no problem. Pitch response appeared to be just a little bit nicer than Run 50. No PIO tendencies or special inputs required. Airspeed control was good. Glide slope acquisition and maintaining glide slope, if anything, seems slightly better, but then maybe it's just me getting re-calibrated. I call it again a 2. Visual: lateral maneuvers are hardly any required; difference from ILS, was essentially the same. The visual seems to be getting easier but I think I'm getting used to it. Flare-touchdown is also a 2, and overall we will call it a 2.

RUN 51-B PR: 2/2/N

With respect to the turbulence and the pitch response, my reaction is more likely to be "what turbulence?". The pitch response seemed to be almost isolated from the moderate turbulence. I could see the airspeed bouncing around but it had very little influence. Pilot rating will remain 2.

RUN 51-C PR: 2/2/N

The effect of turbulence, again as before, had very little influence on the pitch attitude which allowed me to control the rate of decent significantly better than on the previous run. Although lateral-directional excursions were noted as before, pitch and maintaining glide slope was no problem at all considering the heavy turbulence. It is probably a good solid 2 or slightly better.

DATE-RUN: 4/19/80-52 PILOT:A CONFIG: AFO

RUN 52-A PR: 2/2/N

Forces were OK. Sensitivity OK. Lateral-directional, the same. Pitch no problems. No PIO tendencies or special inputs required. Airspeed control perhaps seemed slightly improved (see note). It is a little hard to tell without turbulence. Glide-slope acquisition and maintaining glide slope were all fine. Pilot rating a 2. Visual: pitch control was good. Lateral maneuvers: very little required but no problem. About the same as the ILS. Flare-touchdown is a 2, and overall a 2. (Note: C_{D_1} increased to .341 from .241 of Runs 50. See comment at end of run 4/18/80-52-R.)

RUN 52-B PR: 2/2.5/N

The effect of turbulence seemed about the same as the previous run. It didn't seem to influence things too much. I noticed the airspeed moving around but that was no real problem with control. The lateral maneuver was a bit more of a problem than the pitch certainly, and with attention diverted, I allowed myself to get slightly high but it was no real problem to work it off. ILS portion a 2. Landing-touchdown 2-1/2, and probably overall 2-1/2.

RUN 52-C PR: 2/2.5/N

The effect of turbulence was perhaps slightly more noticeable than the previous run. The pilot rating can be a 2-1/2 for the ILS and the visual and overall. Make the ILS a 2 and the visual and overall a 2-1/2.

DATE-RUN: 4/19/80-53 PILOT: A CONFIG: AF2

RUN 53-A PR: 1.5/2/N

Forces are OK. Sensitivity OK. Lateral-directional OK. Pitch response seemed very stable, very controllable. No PIO tendencies, no special inputs. Airspeed and control was very good. It seemed very stable for a fighter, and that perhaps is misleading. I had to do very little in the way of control inputs, so it appeared very good this time. Glide-slope acquisition and maintaining glide slope was a 1-1/2. Visual was also no problem because I didn't have to do very much. The ILS was about the same. Visual, flare, touchdown is 2, and overall is a 2.

RUN 53-B PR: 3/4/N

The effect of turbulence initially didn't seem to have too much effect, but when it became apparent that I had to make significant pitch changes or control inputs, a bit of a problem began to appear. I found that it seemed to be kind of a subtle, either PIO tendency, or just inability to be able to put the attitude where I wanted it quickly and plow through the gusts. It made the ILS portion probably a 3, and the

flare-touchdown was a 4, and the effect of the lateral maneuver was just to make it more complicated but it made the apparent lack of stability in the pitch attitude much more noticeable. It would appear that we were just not getting the response. "Instability" is not really correct. It seemed to be stable, and if we got bumped by the gusts, it was tough for me to put it back where I wanted it. The overall would be a 4.

RUN 53-C PR: 4/4/N

The effect of turbulence as before was noticeable. The airplane seems to have less controllability than in the previous runs. The stability, noted in the A part, seems to work against you when you run out of control and it makes the airplane quite a bit harder to handle in the turbulence and also in the flare touchdown. It would be a 4 across the board for all effects.

DATE-RUN: 4/19/80-54 PILOT: A CONFIG: F1

RUN 54-A PR: 4/5/N

Forces were OK. Sensitivity OK. Lateral-directional was the same. Pitch response was noticeably not very stable. Slight PIO tendency, but it seemed to be relatively flyable. Airspeed control took a little more attention than prior. Glide-slope acquisition and maintaining glide slope were not too difficult, and that portion would be a 4. The visual portion for some reason became a little more difficult. Perhaps the tendency to use slightly larger control inputs caused the instability to become a more difficult problem to solve. That would be a 5 and overall would be a 5.

RUN 54-B PR: 5.5/7/N

The effect of turbulence was to make the ILS much more difficult to handle, and the ILS glide-slope portion of it is a 5. The visual touchdown is a 7 on the basis that on the first attempt I was not able to make a safe touchdown but was able to execute a controlled go-around without any difficulty.

Run 54-B repeated, the ILS portion is still a 5, or perhaps a 5-1/2. The visual and touchdown portion remains a 7. I managed to land this time, but it was not what you'd consider adequate performance but I could have executed a go around at any point. Overall on the B run combined from both has to be a 7.

RUN 54-C PR: 6/6/N

The effect of turbulence was compensated for, and perhaps because we never got any of the big random gusts at a really bad time, I was able to maintain a trajectory that got all the way to the runway. This particular run, perhaps because there was also no lateral compensation required, would be a 6 for all parts.

DATE-RUN: 4/19/80-55 PILOT: A CONFIG: F4 (δh_{LIM} = -25/10)

RUN 55-A PR: 5/6/N

The forces and sensitivity, lateral-directional OK. Pitch response: the aircraft is quite unstable, but with strong pitch inputs it seems to be controllable. The airspeed control required some work. Glide-slope acquisition and maintaining glide slope required a lot of

attention. The ILS glide slope was a 5. The visual, for some reason, seems to be much more difficult. You can't see the tendency of the pitch as soon as you need to, and it tends to get away from you a little bit. It was quite a bit more difficult than the ILS. The flare-touchdown: was able to land the airplane safely. I would call it a 6, and overall a 6.

RUN 55-B PR: 6/8/N

The effect of turbulence and the lateral maneuver: while the glide-slope portion remained a 6, the visual portion in the flare-touchdown became much more difficult and was probably about an 8. I was not able to land the airplane on the first attempt, however was able to go around from it without losing control.

RUN 55-C PR: 6/9/N

The C run, the effect of turbulence was of course worse. I was just barely able to control the airplane on a go around. I was not able to land it all. That would make the flare touchdown portion a 9, and the overall for both the B and C cases would be 8. In reviewing the ratings for these conditions, the ratings on run 54 B and C portions should probably be harsher - more towards perhaps 8 for the flare-touchdown portions. [Note: Since Pilot A was not able to land the airplane at all, he should have rated the visual and flare-touchdown at 10, even though it was controllable in wave-off.]

DATE-RUN: 4/19/80-56 PILOT: A CONFIG: F4 (δh_{LIM} = -25/15)

RUN 56-A PR: 5/6/N

Forces, sensitivity, lateral-directional all OK. Pitch response: again a kind of a pitch instability that seems to be statically at least divergent. Some PIO tendency and it requires considerable attention to keep the pitch attitude where you want it. Airspeed control does not have any particular speed stability - natural speed stability - so it takes a lot of attention to keep the air speed under control. Glide-slope acquisition and maintaining glide slope initially were not too terribly difficult, but it still requires quite a bit of work and the airspeed also requires a reasonable amount of attention. I call this a 5 for the ILS glide-slope portion. The flare and landing is more difficult, as has been the case with these; however, you have to be very careful with it but you can get it down safely and in reasonable order. I call the flare touchdown on this one a 6, and the overall a 6.

RUN 56-B PR: 5/6/N

The effects of turbulence were noticeable and it made the task just that much more difficult. The ILS glide-slope portion however remains about a 5. The touchdown portion, although I had the feeling that it was always on the verge of getting away, it didn't and I was able to make an adequate landing more or less where I wanted it. I would call it a 6, and overall a 6.

RUN 56-C PR: 5/6/N

The ILS glide-slope portion is pretty much the same. I am able to fly it, keeping the needle pretty well centered, and I call the ILS glide-slope portion a 5. However the visual portion is still considerably more difficult, and the ability to touchdown is perhaps a little bit in doubt. I'd call the touchdown portion a 7, and the overall a 6.

TEST ENGINEERS NOTE:

Nose-down pitch control available was increased from 10 to 15 degrees horizontal tail deflection, going from Run 55 to 56. Since the ratings and comments indicate flying qualties improved going from Run 55 to 56, it may be concluded that nose-down control authority was inadequate in Run 55 and was causing part of the piloting problems in the presence of turbulence.

DATE-RUN: 5/2/80-62 PILOT: R CONFIG: AFO

RUN 62-A PR: 2/2/2

It was started at approximately 145 knots. The feel forces are light. Sensitivity seemed to be OK. Lateral-directional conditions were fine. Pitch response was good. I had good control of the airplane, and airspeed control seemed to be satisfactory for the amount of manuevering that I was doing which was very minimal. I had no difficulty at all acquiring the glide slope and maintaining it and I would put it at a 2. Visual conditions - again I had good pitch control and lateral manuevers were satisfactory. I can't say there was anything different about visual versus IFR. I could hold the glide slope reasonably well, and I would leave the visual at a 2 also. The flare and touchdown were good, give it a 2. Nothing unusual about it. I didn't see any over-controlling tendencies or tendency to porpoise or level off high, or anything like that. I would say that it is a good satisfactory airplane.

RUN 62-B PR: 2/2/2

Was supposed to have been with turbulence but I didn't see any turbulence on that. I would leave my ratings the same. There was an offset. The manuever was very easy to accomplish and didn't create any tendency for over-controlling or porpoising, so I would leave all the ratings the same. [Note: There was no turbulence on this run.]

RUN 62-C PR: 2.5/2.5/2.5

Was with heavy turbulence. No particular problem acquiring the glide slope that time and holding it. It was typical of what I would call regular turbulence. I would rate that at a 2-1/2. I think I would just go to a 2-1/2 all the way through. I was able to come close to my touchdown point on the landing. The sink-rate looked reasonable to me, and I had good control of the airplane throughout the entire condition.

DATE-RUN: 5/2/80-63 PILOT: R CONFIG: FO

RUN 63-A PR: 4/3.5/3.5

Was conducted with a failure of the augmentation system in pitch. The forces were quite sluggish, or I should say the forces were higher and the sensitivity left me with the idea of a sluggish airplane. It took quite a bit of stick motion to get an input in, in pitch. Lateral-directional seemd OK, no particular problem there, but pitch response was what I object to. Airspeed control was OK. No PIO tendencies. I didn't get the impression that the airplane was unstable or anything like that, but I would call it low sensitivity. I could acquire the glide slope and hold it reasonably well but the work load went up. I would probably go to a 4 on the ILS. Visually, I didn't see any particular problems. I can't say that is was any different, and I would go to about a 3-1/2 on the visual, and about a 3-1/2 on the flare and landing. Visually, I didn't see any porpoising tendencies or tendencies to create a problem in landing short or long. I think it was a little easier visually than it was under IFR conditions.

RUN 63-B PR: 4.5/4/4

Was with moderate turbulence. Airplane still feels a little sluggish in terms of pitch sensitivity, but I could maintain the glide slope reasonably well. I would probably go to about a 4 1/2 in the turbulence on the ILS portion of it. Under VFR conditions, I ran into a little trouble in over-controlling and I got some tendency to start porpoising when I first broke out. I had a little trouble controlling the touchdown, so I elected to go around. I would say that the VFR portion on the first one, on this particular run, was probably about a 5. But I could not complete the flare and landing. We repeated the run then, I got about the same results in the IFR portion of it. However, on the VFR portion, I found that it was easily controlled this time. I didn't get into the tendency to over-control it, and I went ahead and completed the landing satisfactorily. I would put it at a 4 for both the visual and flare and landing. For some reason, it just didn't given me much trouble on the second attempt.

RUN 63-C PR: 5/5/5

Was heavy turbulence. I would go to about a 5 on the configuration, as far as the ILS and VFR conditions are concerned, there is really not much difference. In the landing, I had a tendency to be a little bit on the long side, however I was able to get it down reasonably good. But I had to compensate for a high sink-rate initially that caused me to land a little bit long, but I would go for a 5 on it also.

DATE-RUN: 5/2/80-64 PILOT: R CONFIG: F4

RUN 64-A PR: 7/7/8

Was in calm air with a stability augmentation failure. The airplane was definitely unstable, at the start of the run, and I had some difficulty at first just damping out the tendencies for it to want to pitch on its own - up or down - depending on which way it started, but it was controllable, didn't get away. The lateral-direction was OK. There is a slight tendency for the PIO because of this unstable condition, but I could damp it out easily. Airspeed control was a little more difficult because of the unstable tendency. I could fly the glide slope with it. I would rate it about a 7. Ability to maintain the glide slope was difficult, but it could be acquired. I just had to keep working at it - staying on it. I didn't notice much difference visually. I would go to a 7 visually. Not aware of any problems associated with pitch due to lateral movement or anything like that, but I would put it about the same for VFR and IFR. The landing resulted in quite a long landing and it was due to tendency to porpoise a little in trying to get down to the runway. It was difficult to control sink-rate, but I was able to land it. I would put it at an 8 for the landing.

RUN 64-B PR: 8/8/9

Was with moderate turbulence. The ability to track the glide slope and localizer together were a little more difficult. I would go to an 8 for the condition with turbulence. The workload got quite high in trying to stay on both localizer and glide slope. I didn't have any trouble, however, until I broke out and then I ran into trouble trying to establish the sink-rate for touchdown. I had to go around the first time. We

repeated that run, and I would say that both IFR and VFR were both an 8. I would go to a 9 on the landing. I was able to get it down. It was quite long, and I had trouble establishing a good sink-rate again. There is a tendency to over-control and get a porpoising going, that you just can't predict when you will touch, in the high sink-rate or the low sink-rate. It is very marginal.

RUN 64-C PR: 8/8/9

Was heavier turbulence, again about the same kind of problems on the IFR and VFR portion of the localizer and glide slope. Difficult to stay on the glide slope. The last, I broke out visually a little bit high and just no chance of getting down, so I didn't attempt to land. I went around. I still leave the IFR and VFR portions of it at an 8, and will try another run on the landing. The repeat of the 64-C, heavy turbulence, resulted in a landing that was quite long. I would stay at a 9 with it, I think it can be landed, but it is extending the capabilities to just about its limits.

DATE-RUN: 5/2/80-65 PILOT: R CONFIG: L21

RUN 65-A PR: 2/2/2

Was in smooth air at 120 knot approach speed. The airplane responded quite well. Control inputs: as far as feel was concerned the forces felt OK. They were on the light side. Sensitivity is good. In fact, it might be a little bit high in sensitivity, but it didn't cause any over-controlling in pitch or anything like that. Lateral-directional was good. No PIO tendencies, no requirements for special inputs, and airspeed control seemed to be good. There was no problem acquiring the glide slope and staying on it, and I'd rate it at a 2. Visually, I didn't see any pitch problems. Lateral maneuvering was kept to a minimum. We broke out right on the center line so I didn't have to do much lateral maneuvering visually. But I would say that the visual portion of it was about the same as the IFR portion. Give it a 2. The flare and touchdown was good. No over-controlling tendencies or anything like that. Should have been a good sink-rate at touchdown. I would give it a 2.

RUN 65-B PR: 3/3.5/3.5

Was with turbulence. I couldn't see any particular problems with the ILS localizer capture or maintaining the glide slope. The pilot rating - about a 3 for the ILS portion of it. I would go to a 3-1/2 for the visual. I noticed that I did have a tendency to over-control a little bit once I got visual, but I didn't get any persistent porpoising, but I found myself cycling the column in pitch. The landing was satisfactory but slightly long. I had a little bit of crab in it at touchdown, but it was easily controlled. I would put it at 3-1/2.

RUN 65-C PR: 4/4/5

Was with heavy turbulence. The condition is satisfactory to fly under IFR conditions. Sensitivity is a little bit high and turbulence seems to aggravate it slightly. There is a little more stick action, you might say, but it is not difficult to hold the glide slope. Under VFR conditions, I noticed a tendency to use a little more oscillation on the stick. I guess I would go about a 4 on each of the IFR and VFR conditions

maintaining glide slope, but I would go to about 5 on the landing. I was having a little more trouble getting the sink-rate down where I wanted it and part of it, I think, is due to the stick sensitivity being just a little bit high.

DATE-RUN: 5/2/80-68 PILOT: R CONFIG: L71

RUN 68-A PR: 4/3.5/3.5

RUN 68-A was in smooth conditions. I couldn't tell whether there was a failure involved, but the sensitivity seemed to be a little on the low side. It looked a little sluggish in pitch. Lateral-directional hadn't changed that I can see. The forces are OK, but just sluggish response. Looked like pitch damping was on the low side. Didn't require any particular high workload or anything like that. I would put it at about a 4 for the IFR portion of the glide slope. It seemed to follow pretty closely the inputs to stay on the glide slope. VFR seemed to be just a little bit easier. I would go for a 3-1/2 on the VFR, and I would put it about 3-1/2 on the landing. Tendency to be just a little bit long in trying to get the airplane down, it's controllable, but a bit sluggish in response.

RUN 68-B PR: 5/4/5

Moderate Turbulence - I would put it at about a 5 for IFR tracking on the glide slope, again due to being on the sluggish side. The workload is a little higher than normal. Airspeed control is a little more difficult. I would put the VFR portion of it at 4. Probably the flare and touchdown I would put it at about a 5. There was a tendency to be a little bit long and not quite as accurate on touchdown. However, I could maintain the center line without too much trouble. I just felt that it was a little more touchy on the flare and landing, and it is mostly due to kind of a sluggish feeling. It looks like it is very low damping in pitch - low sensitivity.

RUN 68-C PR: 6.5/6/6

Heavy turbulence - workload again was a big problem. Even though it was still on the sluggish side, the IFR, I would go for about a 6-1/2 on the VFR, and the flare and touchdown about a 6.

DATE-RUN: 5/2/80-69 PILOT: R CONFIG: L72

RUN 69-A PR: 6/5/5

Was in smooth air. Nothing peculiar about the forces. The airplane looked again unstable. I could control it however. Lateral-directional was OK. No special requirements for damping it out or anything like that. You just had to spike it to stop the pitch up or pitch down that resulted if you let it wander a little bit. A fairly difficult airplane to control speed wise. You could do a good job of holding the glide slope, but workload was a little on the high side. I would put it at a 6 for the IFR portion. I thought the VFR portion was better than that. It seemed to smooth out quite easily with very small inputs. The larger the inputs, the worse it gets in terms of handling. You can damp it out easily and make small corrections. I'd give the VFR portion a 5, and the landing a 5. It turned out that the flare and landing was quite easy to handle.

RUN 69-B PR: 6/5.5/5.5

Was with moderate turbulence. I couldn't say that I increased my workload that much more. I would leave the IFR portion at a 6. Maybe go to a 5-1/2 on the VFR, flare and touchdown. It didn't seem to affect it that much. It didn't present any real serious problems, but I thought I had reasonable control of it considering it was as unstable as it is.

RUN 69-C PR: 6/5.5/5.5

Was with heavier turbulence, but I couldn't see any effect from it. It left me with the impression that it was about the same as the moderate turbulence. The airplane is flyable and I was able to get it down reasonably close to where I wanted. I would rate it a 6, 5-1/2 and 5-1/2.

DATE-RUN: 5/2/80-70 PILOT: R CONFIG: L73

RUN 70-A PR: 7/6/7

Was in smooth air. The airplane is an unstable airplane and seems to diverge a little more noticeably than previous runs, in an unstable condition. I assume that the stability augmentation has failed in some way. Just resulted in workload being higher and I was having more difficulty staying on the glide slope. Airspeed control was more difficult. There were times when I noticed that I was at idle thrust, trying to get down to get on to the glide slope and keep the airspeed down. I would put the ILS and capture under IFR conditions at about a 7, and the VFR probably at about a 6. The problem is to keep the control input small. If they get very large, it is very difficult to handle the sink-rate on touchdown. I did notice on the flare and touchdown, that I made an attempt to flare and it leveled off a little too much and I was having a little trouble getting it controlled for the touchdown. I would go about a 7 on the touchdown as a result of that.

RUN 70-B PR: 7.5/7/7

Was with turbulence - moderate turbulence. I was able to capture the glide slope and get it down OK. I would go probably about a 7-1/2. It didn't seem to cause workload to go up excessively, but it is noticeably a little higher in the IFR portion. The ability to fly it VFR is probably about a 7, not quite as hard as the IFR, and I would put the flare and landing at about a 7. I think there is again the tendency to have to keep inputs down to a minimum, and it would be very easy to overshoot if we got a large input going and attempted to stop a higher sink-rate.

RUN 70-C PR: 8/8/8

Was with heavier turbulence. I was having trouble maintaining the glide slope and localizer on that particular run under IFR conditions. The biggest problem is that the airplane is guite unstable and turbulence is aggravating it somewhat. I didn't see a lot of difference, but I think I would go an 8 across the board for IFR, VFR, and for the flare and landing. I got it down without what I would call excessive sink-rate and I was reasonably close to my touchdown point, but had to keep the inputs quite small and keep it from pitching excessively. The secret of it is to just make very small inputs.

DATE-RUN: 5/5/80-62 PILOT: A CONFIG: AFO

RUN 62-A PR: 3/3/3

Forces, sensitivity, lateral-directional all OK. Pitch reponse no problem. It seems just a bit reluctant to do what I want it to do. No PIO tendency. Special inputs: takes a little bit more attention to pitch than I like. The vertical speed has a tendency not to give you exactly what you want. Glide slope acquisition was OK. Maintaining glide slope was OK. ILS glide-slope portion would be 3. Visual: pitch control was essentially the same, lateral maneuver was not required, and about the same as the ILS, again a 3. Flare and touchdown not real difficult, but the pitch is just a little bit touchy, again a 3.

RUN 62-B PR: 3/3/4

Effect of turbulence seems to aggrevate the slight resistance of the airplane to do what you want. Pitch seems to respond OK, but the rate of descent does not necessarily follow, which makes it a little more difficult to fly in turbulence than other configurations. The lateral maneuver resulted in a couple of pitch changes. It seemed to accommodate OK. ILS portion is a 3, visual a 3, and flare touchdown a 4.

RUN 62-C PR: 4/4/5

Effect of heavy turbulence continues to aggrevate the ability to control pitch. ILS portion is a 4, visual a 4, and flare touchdown a 5.

DATE-RUN: 5/5/80-63 PILOT: A CONFIG: FO

RUN 63-A PR: 4/4/3

Forces, sensitivity, lateral-directional are all OK. Pitch response: slight reluctance of the airplane to respond in pitch to a control input, but the airplane seemed to be fairly stable with respect to vertical speed and stable also with respect to pitch. The airspeed control was not really a problem. ILS glide-slope acquisition and maintaining glide slope required some extra compensation due to the reluctance of the airplane to do what it was told, requiring a little nudging, but once you got it where you wanted it, it seemed to stay OK, and didn't go wandering off. Rate it a 4. Visual was essentially the same. No more difficult, no tendency to get away. Also a 4. Flare touchdown portion - no problem at all. In fact, it behaved quite well. This combination a 3.

RUN 63-B PR: 4/4/4

Effect of tubulence was noticeable, but this level didn't seem to materially degrade the ability to control the airplane. It definitely does not have any PIO tendency or tendency to diverge. It is just a bit of a nuisance to get the pitch you want, from the standpoint of having to put it there and then the airplane seems to follow OK. ILS portion remains a 4, visual a 4, and flare touchdown, a 4.

RUN 63-C PR: 5/4/5

The effect of turbulence definitely was noticed. The ILS portion is a 5. Visual - essentially the same except the lateral mode, which is the basic lateral mode we have seen all along, seemed to be as difficult to handle as this particular pitch mode. Visual portion a 4, and flare

touchdown a 5. Overall comments - On this particular run, the pitch was well controlled. It required a little bit of control action that is somewhat unusual in that it takes a very positive movement to move the pitch, but the results give you the vertical speeds you want. On the visual, the pitch very definitely seems to go exactly where you want it, given a reasonable control input, and doesn't spring back or over-shoot or any of the other undesirable tendencies even in this failure mode. This makes a fairly controllable situation in comparison to some of the others.

DATE-RUN: 5/5/80-64 PILOT: A CONFIG: F4

RUN 64-A PR: 6/6/6

Forces, sensitivity, lateral directional are all OK. Pitch response: very definitely unstable pitch problems that had to be continually damped out with control inputs. Definite PIO tendency. Airspeed required constant attention. Glide-slope acquisition and maintaining glide slope were relatively difficult even with the still air. Pilot rating for the ILS portion a 6. Visual portion: pitch control about the same. You very definitely have to be on top of it and not permit any unusual pitch excursions, because it appears very strongly that you won't get it back. Lateral maneuver was not required fortunately, and it seemed to be about the same in difficulty as the ILS. Pilot rating also a 6, and flare-touchdown was a 6. This particular landing worked out alright, but I am not sure that I was able to get the complete flare the way I wanted it, and I am not sure what would have happened if I had really tried to do it. Turbulence will certainly tell.

RUN 64-B PR: 7/9/10

Effect of turbulence very definitely was noticed. It made the ILS portion a 7. I was just not able to maintain the glide slope within desired parameters. Combination of visual and lateral maneuver required was sufficiently distracting to just completely lose the desired glide slope. That would probably result in this particular case a 9, because primarily we wound up landing short, completely short, of the runway. Flare-touchdown: we never really reached it. [Note: Flare-touchdown assigned a 10 due to landing short of runway.]

RUN 64-C PR: 7/9/10

Effect of heavy turbulence was very noticeable. The ILS glide-slope portion remains a 7, visual a 9, and flare-touchdown a 10.

DATE-RUN: 5/5/80-65 PILOT: A CONFIG: L21

RUN 65-A PR: 3/3/3

Forces, sensitivity, lateral-directional all OK. You might note that the lateral-directional, in this particular series, seems to be considerably more stable and easier to fly than in the previous block. Pitch response is fine. It's got a little bit of rubbery feel to the reaction. The control forces, breakout, sensitivity and everything is just fine, but as far as the reaction of the pitch to control inputs, it seems to be just a bit springy, but it poses no real problem. The airplane seems to be quite stable. Airspeed is fairly solid. ILS glide-slope acquisition and maintaining glide slope is a 3. Visual is

certainly no more difficult. No lateral manuever was required. Call it also a 3. Flare-touchdown a 3.

RUN 65-B PR: 4/5/5

Effect of turbulence was most noticeable in that the pitch bobbled around quite a bit by itself, but the vertical speed was well controlled by overriding pitch inputs. Airspeed seemed to be relatively stable. The pitch bounce probably is the more annoying detail, except that flying the ILS was still not degraded that much. Call ILS portion a 4. The visual was perhaps a little more distracting and required a little more attention to the glide slope, and the illusion----(Pilot comments lost at this point.)

TEST ENGINEERS NOTES:
RUN 65-B pilot ratings were 4/5/5.
RUN 65-C pilot ratings were 5/5/5. Pilot said effect of turbulence was very noticeable. However pitch excursions and control of vertical speed were not too bad.

DATE-RUN: 5/5/80-66 PILOT: A CONFIG: L73

RUN 66-A PR: 5/4/4

Forces, sensitivity, lateral-directional all OK. Pitch response - seems to be overly sensitive to pitch. Poorly damped, but stable in behavior in the sense that it does not tend to diverge, even if you get a little bit carried away. You can easily damp the pitch motion out with control movements and the vertical speed and glide path behavior seem to be less dependent on the pitch excursions then some other cases. Air speed control not excessively difficult. The ILS glide-slope acquisition and maintaining glide slope require a considerable amount of attention, but can be maintained. Call it a 5. Visual seemed this time somewhat easier than the ILS portion. I would call it a 4, and the flare touchdown a 4

RUN 66-B PR: 6/5/5

Turbulence made the pitch activity more noticeable and made it more difficult to fly the ILS glide slope, but again, the airplane seems to respond in terms of the performance if not the pitch. ILS glide slope portion is 6. Visual, for some strange reason, seems to be slightly easier. Visual is a 5. Flare-touchdown a 5

RUN 66-C PR: 6/5/5

Even in heavy turbulence, the ILS glide-slope portion remains a 6. It looks a lot worse than it actually is. Again, it seems to be an overly sensitive, poorly damped pitch that leaves the airplane essentially stable or trying to be stable in the flight path problem. The airspeed tends to wander around a little more than I'd liked as a result of this, but again, I can maintain glide slope fairly well. ILS portion is a 6. Visual, again is easier, a 5. Flare-touchdown, 5. Even with a fairly good lateral offset and other problems, was able to settle it back down and put it just where I wanted.

DATE-RUN: 5/5/80-68 PILOT: A CONFIG: L71

RUN 68-A PR: 4/3.5/3

Forces, sensitivity, lateral-directional - all working fine. Pitch response seems a little bouncy - no PIO tendency, but it requires just a little bit of manual damping to keep the pitch from bouncing around more than you want. Airspeed is just a shade sluggish. The airplane seems to behave well as far as maintaining glide slope in spite of the tendency to pitch around more than you would like. The ILS portion is a 4. Visual, again for some reason, seemed a little easier. The visual portion we can call a 3-1/2. It was a little easier and no lateral maneuver was required, and the flare-touchdown was a 3.

RUN 68-B PR: 4/3/3

The effect of turbulence was noticable in that it tended to bounce the pitch around a little more; however, the airplane seemed to plow through the turbulence with no difficulty. Maintaining glide slope didn't seem to be really much more difficult than the A run. Still required compensation for the pitch bobbles, but it remains at 4. The visual portion, even with the lateral offset maneuver, was actually easier. Considering the difficulties induced by the lateral maneuver, it was a solid 3. Flare-touchdown was also a 3.

RUN 68-C PR: 5/4/4

Effect of heavy turbulence was noticed throughout and made everything more difficult. The ILS glide-slope portion is a 5. The visual, again for some reason with this particular situation, it was easier. It's a 4. (Section of tape lost here. From test engineers notes, the pilot rated flare-touchdown a 4.)

DATE-RUN: 5/5/80-69 PILOT: A CONFIG: L72

RUN 69-A PR: 4/4/4

Feel forces, sensitivity, lateral-directional were all OK. Pitch response: slight potential PIO tendency, but not too bad. Must be careful with the pitch. Airspeed control seemed reasonably stable. Seemed a little more stable than the previous cases. ILS glide-slope acquisition and maintaining glide slope were all pretty much OK. Rating a 4. The airplane seemed quite solid in its ability to maintain the flight path even though the pitch required a little bit of maintenance. Visual: this time about the same as the ILS glide slope. Had a tendency to sneak down a little low that I hadn't really intended. It's also a 4. Flare-touchdown seemed to exhibit at least the potential for a little bit of PIO in the flare, but I didn't really let it get away, so I didn't get the full effect of it. So I will call it also a 4.

RUN 69-B PR: 5/5/5

The effect of turbulence was noticeable. Made it increasingly more difficult to maintain the glide slope within the desired parameters because of this pitch effect. However, the vertical speed does follow nicely. It makes the ILS portion a 5. The visual: again about the same, also a 5. Flare-touchdown will be a 5.

RUN 69-C PR: 5/5/5

The effect of the heavy turbulence was noticed, but it didn't seem to be any more difficult than the previous case. Call it a 5 for the ILS glide-slope portion, a 5 for the visual, and a 5 for the flare-touchdown.

SUMMARY COMMENTS FOR RUN 69

Although the pitch instabilities required constant attention, the flight-path angle was always readily maintainable in all cases, making the airplane flyable, and you are able to do the kind of job you want to do with it even though you have to work at it.

DATE-RUN: 5/5/80-70 PILOT:A CONFIG: L73

RUN 70-A PR: 5/5/4

Forces, sensitivity, lateral-directional, all OK. Pitch response is quite unstable, mild PIO tendencies, but it requires quite a bit of attention to keep it from going off in the direction that it's been nudged. Airspeed control seemed a little more difficult this time, wanted to get a little fast without any particular trim effect. ILS glide-slope acquisition and maintaining glide slope are a 5. Visual: again seemed about the same. It didn't seem to get any easier or harder. It remains a 5. Flare-touchdown probably a 4.

RUN 70-B PR: 6/7/6 [But use pilot rating for 70-B from repeat which follows 70-C.]

The effect of turbulence magnified the pitch instability. It also looked like there was a bit of dead band in the response, where you would move the control and nothing would happen in pitch, which, if that is true, whatever the problem, aggravated the situation particularly with turbulence. The ILS glide slope portion would be a 6. Visual for some reason showed up a little more difficult this time. I was not able to maintain the glide slope. I wound up landing a lot longer than I intended to. It generated a balloon that I hadn't really countered very well. Visual portion we'll call a 7. Flare-touchdown a 6. Also the airspeed seemed to be wandering around, strictly as a result of power, and had very little influence on the trim. [TEST ENGINEERS NOTE: When the pilot applied lateral control in rolling out and lining up with runway after lateral offset, horizontal tails hit the stops due to the lateral input and caused an uncommanded pitch inputs. This was the source of the pilot's problems and the "balloon". To verify this, and to eliminate the effects, the tail limits were increased from $-25^{0}/+15^{0}$ to $-30^{0}/+20^{0}$, and 70-B run again after 70-C.]

RUN 70-C PR: 6/6/6.5

The ILS glide-slope portion, as before, the turbulence made it very difficult to maintain the glide slope within reasonable parameters. It is a 6. The visual is a 6-1/2. The lateral maneuver, on the B case, just got me out of whack completely. This time a 6-1/2 is reasonable for the visual portion, the flare-touchdown a 6.

RUN 70-B - Special Case (Repeat) PR: 6/6/6.5

Effect of turbulence was again quite noticable, and the ILS glide slope portion remains a 6. This is the same configuration that was run in

70 A-B-C with minor change. The visual: the effect of the lateral maneuver was noticable, but it did not seem to materially degrade from what we had already seen, it stays a 6. However, the flare and touchdown was a 6-1/2 this time. [See note following Run 70-B above.]

DATE-RUN: 5/5/80-73 PILOT: A CONFIG: L21

RUN 73-A PR: 3/3/3

Forces, sensitivity, lateral-directional all OK. Pitch response: no PIO tendency at all, quite the reverse, it seemed resistant to pitch inputs. It took a more definite positioning of the controls to get the pitch input desired, and it seemed to have almost a spring-back tendency. But once you put it someplace, it seemed very stable. Airspeed control seemed pretty solid. ILS glide-slope acquisition and maintaining glide slope was really pretty easy, it took a little bit of attention to compensate to the seeming stiffness in pitch, but it made it pretty easy to hold the glide slope once you got on it. ILS is a 3. Visual: was essentially the same, if not just slightly easier, also a 3. The flare-touchdown is a 3.

RUN 73-B PR: 4/3.5/3

The effect of turbulence aggrevated whatever kind of problem we are having in pitch. The turbulence caused the pitch attitude to bounce around by itself, and the sluggish response in pitch attitude to correct it was noticed, but the vertical speed seemed somewhat unaffected which made maintaining the glide slope not as difficult as it might otherwise have been. However, the ILS glide-slope portion would be 4. The visual, including the lateral maneuver, seemed perhaps slightly easier than the ILS portion, 3-1/2. The flare-touchdown was very well controlled at a 3.

RUN 73-C PR: 5/5/4

Effect of turbulence began to very noticeable aggravate the situation. The undesired pitch excursions started to get fairly large. The ILS glide-slope portion is a 5. The visual is the same type of a problem, possibly slightly easier, but not much. Also a 5. Flare-touchdown is a 4.

DATE-RUN: 5/5/80-74 PILOT: A CONFIG: F6

RUN 74-A PR: 6/6/6

Forces, sensitivity, lateral-directional OK. Pitch problems: it looked like an unstable airplane with a very laggy, weak pitch response to controls. It took a lot of attention to maintain the pitch where we wanted it. Airspeed control was not easy, it took some attention. Glide-slope acquisition and maintaining glide slope were reasonably difficult. Pilot rating a 6. Visual: a little different, but no harder, no easier. Also a 6. Flare-touchdown was also a 6. We were very careful, it pretty much goes where you want it, but it looks like it has some very dangerous potential.

RUN 74-B PR: 6/6/7

Effect of turbulence was noticeable but didn't seem to too greatly degrade the ILS portion. It remains a 6. The visual portion also a 6.

The flare-touchdown however is a 7. Lateral maneuver was accomplished reasonably well without getting into too much trouble. Also there was a noticable PIO tendency right at the flare. That is why I called the flare-touchdown a 7.

RUN 74-C PR: 6/6.5/8

The turbulence was very noticeable. However, the ILS portions still remain a 6. The visual, a 6-1/2. It was getting a little bit borderline, particularly close in, and the flare-touch down is degraded to an 8. It has very definite PIO tendency that you really have to stay on top of.

DATE-RUN: 5/5/80-75 PILOT: A CONFIG: F2

RUN 75-A PR: 7/7/7

Forces, sensitivity, lateral-directional all OK. Pitch response: very definite instability and lack of authority to dampen it and control it. It required continuous attention to keep the pitch attitude within some kind of desired parameters. Keeping the glide slope and vertical speed consistently within acceptable limits was not possible. Generally able to herd the thing down the glide slope, but not with the desired precision. Airspeed control got away a few times, but we were able to keep it more or less where we wanted it. ILS glide-slope acquisition and maintaining glide slope will be a 7. Visual: no lateral maneuver was required. Pitch control was still as difficult as the ILS. Pilot rating is a 7. Flare-touchdown: by being very careful with it and not letting it out of control, we were able to make a safe landing, but we are not sure if we were able to control the flare to get the sink-rate stopped. It's also a 7.

RUN 75-B PR: 7/8/9

Effect of turbulence was very noticable and aggravating the mentioned instabilities. Lateral maneuver increased the workload but did not seem to adversely affect the pitch any more than it already was. ILS glide slope is a 7. The visual, particularly close in, is an 8. Flare-touchdown, was a 9.

RUN 75-C PR: 8/9/9

Effect of heavy turbulence considerably degraded it. Made the ILS glide-slope portion an 8. Visual portion, very strong PIO tendency, particularly close in, a 9. Flare-touch down, also a 9. Flare-touchdown may tend to possibly be even worse than a 9, depending on how the final touchdown really worked out. [Pilot, since he can not feel touchdown impact, assumes recorded sink-rate at touchdown will define "how (it) really worked out".]

DATE-RUN: 5/5/80-76 PILOT: A CONFIG: F4

RUN 76-A PR: 5/6/7

Feel forces, sensitivity, lateral-directional all OK. Pitch response: instability in pitch. Not as much PIO tendency as the earlier case. It required constant attention, but airspeed wasn't quite as critical. It just didn't seem quite as bad as the previous case. The aircraft seemed to be a little more stable with respect to the glide

slope, although the pitch bobbled around a lot. Glide-slope acquisition and maintaining glide slope is a 5. The visual tended to be worse for some reason. No lateral maneuver was required. It is a 6. The PIO tendency began to show in the flare-touchdown area, making it very difficult to control the airplane. A 7 for the flare-touchdown.

RUN 76-B PR: 5/6/8

Effect of turbulence was noticeable on the ILS portion but more so farther in. The ILS remains the same, at a 5. Visual and lateral maneuver were affected, but we were still able to stay where we wanted pretty much. They are a 6. Flare-touchdown area was very difficult and it is an 8.

RUN 76-C PR: 6/7/9

ILS portion is a 6. Turbulence was very noticable. Made it very difficult to maintain the glide slope within parameters. The visual portion: was not able to stay where I wanted it to stay, to set it up for proper flare. It is a 7. Flare-touchdown was a 9.

DATE-RUN: 5/5/80-77 PILOT: A CONFIG: F2

RUN 77-A PR: 8/8/8

Feel forces, sensivitity, lateral-directional OK. Pitch response: very strongly divergent pitch instability that took considerable attention to keep it dampened out most of the time. Airspeed tended to get away, mostly because my attention was diverted, not because it tended to wandered by itself. Glide-slope acquisition and maintaining glide slope were very difficult and I was not able to maintain it within the desired parameters consistently at all. There were times when I had to really work to just hang onto control. ILS glide-slope portion is an 8. Visual: pitch control essentially the same. Lateral maneuver was not required. Also an 8. Flare-touchdown: nothing really bad happened. I managed to get the thing pointed in the right direction and leave it alone. So it will remain an 8. I didn't really have to fight anything that got out of control, so will find out what happens in the turbulence.

RUN 77-B PR: 9/9/9

ILS glide-slope portion was made considerably more difficult with the turbulence. Any inattention at all would start divergent oscillations that had to be dampened out quickly, with potential for immediate loss of it. ILS is a 9. Visual a 9. Flare-touchdown a 9.

RUN 77-C PR: 9/9/9

Effect of turbulence again was considerable and the pilot rating remains a 9 for the ILS, 9 for visual and 9 for flare-touchdown.

DATE-RUN: 5/6/80-80 PILOT: A CONFIG: AF4

RUN 80-A PR: 2/2/2

Forces, sensitivity, lateral-directional are all OK, except we have noted that the stick itself seems to have a slight dead band which has probably been present all along. Pitch response is very good. No PIO tendencies. Airspeed control is solid. ILS glide-slope acquisition and

maintaining glide slope were no problem. Its a 2. Visual: no lateral maneuvering was required. It maybe seems a little bit harder than the ILS, but not significantally. It is also a 2. Flare-touchdown is also a 2 for this particular situation.

RUN 80-B PR: 3/3/4

The turbulence was most noticable in the area of the glide slope and vertical speed. Didn't seem to influence pitch very much, but very small pitch influences seem to have a fairly strong effect on the vertical speed and glide slope. The aircraft behaved as if it was not really insulated very well from the effects of the gusts. It made the ILS glide-slope portion more difficult to fly. It is a 3. The visual portion was also degraded. It is a 3. Flare-touchdown tended to be a little more difficult yet. It is a 4.

RUN 80-C PR: 4/4/4.5

The effect of large turbulence is very noticeable. Again, the pitch is not affected by the turbulence, but the glide slope is and it takes fairly significant pitch changes to influence the vertical speed and glide slope which makes it more difficult than it seem like it should be for flying in turbulence. The ILS glide-slope portion is 4. The visual this time seemed about the same, also a 4. Flare-touchdown: there seemed to be a tendency perhaps to overshoot a little bit on setting the attitude for landing the way you wanted it and getting the flare established, which is a 4-1/2.

DATE-RUN: 5/6/80-81 PILOT: A CONFIG: F4

RUN 81-A PR: 5/5.5/6

Forces, sensitivity, lateral-directional were all OK, or as noted before. Pitch response: the airplane had a very noticable instability that had to be continuously countered to keep the pitch from going off in an undesired direction. Airspeed control didn't seem too difficult. Glide-slope acquisition and maintaining glide slope took constant attention, particularly close in, it was quite difficult. It would be a 5. Visual portion seemed about the same. Perhaps a little bit of a PIO tendency. I would call the visual portion a 5-1/2. Flare-touchdown: I probably should have worked just a little harder to put it where I wanted it, but it would be a 6.

RUN 81-B PR: 6/6/7

The effect of turbulence made flying the ILS glide slope much more difficult by magnifying the tendency to get away in pitch; however, the airplane seems to maintain the vertical speed reasonably well although the ILS glide slope portion will be a 6. Visual was approximately the same. The lateral maneuver didn't pose any real difficulty. It is about the same as the ILS, call it a 6. Flare-touchdown: very definite PIO tendency and we will estimate at a 7. Although this particular run was compromised by a glitch in the visual system, I believe it would not have affected it. It would have been a 7 anyway.

RUN 81-C PR: 6/6/7

81-C is the same essentially as 81-B. No lateral maneuver was required particularly, but the effect of turbulence was as before. ILS glide slope portion a 6, and the visual a 6, and the flare-touchdown portion is a 7. I am just not quite able to put it where I want it.

DATE-RUN: 5/6/80-82 PILOT: A CONFIG: S42A

RUN 82-A PR: 6/6.5/8

Forces, sensitivity, lateral-directional were all OK. Pitch response was very noticably unstable and took continual inputs and fairly significant pitch inputs to stop the tendency for the pitch to just get away. Very definite PIO tendency or potential. Airspeed was very tough to control. Very speed insensitive to trim. Glide-slope acquisition, maintaining glide slope was quite difficult. It is a 6. Visual seemed, if anything, slightly more difficult. Call it a 6-1/2. Flare-touchdown was definitely more difficult with noticeable PIO tendency. Call it an 8.

RUN 82-B PR: 6/7/8

The turbulence made a noticeable difference in the configuration, made it much more difficult. The ILS glide-slope portion is a 6. Visual, with the complications of the lateral maneuvers and everything, is a 7. Flare-touchdown was an 8.

RUN 82-C PR: 7/7/8

Heavy turbulence made the ILS glide slope even more difficult. It is a 7. I am just not able to stay within the desired parameters. Visual is essentially the same. Just can't quite put it where you want it. Flare-touchdown is even more difficult. Probably an 8 maybe an 8-1/2. [Test engineers notes give pilot ratings of 7/7/8, probably based on unrecorded comments by pilot after formal taping of comments.]

DATE-RUN: 5/6/80-83 PILOT: A CONFIG: S43A

RUN 83-A PR: 5/5/7

Forces, sensitivity, directional still OK. Pitch response: noted instability, but after flying it a little bit, it was not quite as bad as some of the previous cases. PIO tendency was less. Airspeed control was difficult, but not as bad as it was on the previous case. ILS, glide-slope, acquisition and maintaining were noticably easier. ILS is a 5. Visual seemed essentially the same, although I was set up well enough I didn't have to do too much until the flare. We will call the visual this time a 5. However, the flare-touchdown just didn't seem to go where I wanted it to go. There was definitely some tendencies there that were not real good. I would call that a 7 for the flare-touchdown.

RUN 83-B PR: 6/7/8.5

The effect of turbulence was noticeably destablizing. It makes the ILS portion a 6. Visual portion at first seemed about the same, but it was harder to control in some of the sink excursions that got away, particularly after the lateral maneuver. Visual portion is a 7. Flare-touchdown: the control just doesn't seem to be there to set the thing up the way you want it, and I would call it an 8 1/2.

RUN 83-C PR: 7/7/9

ILS glide slope portion is a 7. Visual is essentially the same, and the flare-touchdown is a 9.

DATE-RUN: 5/6/80-84 PILOT: A CONFIG: S44A

RUN 84-A PR: 5/5/7

Feel, sensitivity, forces, lateral-directional were all OK. Pitch response: noted instability and kind of a sluggishness to respond to controls. Airspeed control didn't seem too difficult. ILS glide-slope acquisition and maintaining glide slope a 5. Visual seemed about the same, also a 5. Flare-touchdown, however, had problems with that. It is a 7.

RUN 84-B PR: 6/6/6

Effect of turbulence degraded the approach a little bit. It made the ILS portion a 6, and the visual is the same. This time the flare-touchdown seemed well controlled, but we landed a little bit farther down than I wanted to. Call it a 6.

RUN 84-C PR: 7/6/6

The turbulence seemed to have more effect on the ILS glide slope portion, but the visual, if anything, seemed a little better at this stage of it. The ILS glide slope portions is a 7, visual a 6, and flare-touchdown a 6.

DATE-RUN: 5/6/80-85 PILOT: A CONFIG: S41A

RUN 85-A: PR: 6/5/6

Forces, sensitivity, lateral-directional were all OK. Pitch response: noticeably unstable with PIO potential. It required constant attention to keep the pitch under control. But by keeping the pitch under control, it seemed to follow vertical speed and glide slope OK. Airspeed was not too hard to keep under control. ILS portion, maintaining glide slope is a 6. Visual, if anything, seemed a little bit easier for the visual portion. That was a 5. No lateral maneuvering was required, however. Flare-touchdown was a 6.

RUN 85-B PR: 7/7/8

Effect of turbulence was destablizing and increased the workload. The airspeed was harder to maintain. The ILS portion is 7. I was only able to keep a couple of the parameters within boundaries at any given time. Third one was always out. The visual portion was about the same. I couldn't quite get the thing on to glide slope and hold it where I wanted it, and the flare-touchdown was an 8.

RUN 85-C PR: 8/7/9

The effect of turbulence was very destablizing and made the ILS glide-slope portion very difficult. The ILS glide slope is an 8, and the visual portion is a 7. It was slightly easier. But the flare-touchdown is really a problem, so it's a 9.

DATE-RUN: 5/6/80-86 PILOT: A CONFIG: S45A

RUN 86-A PR: 5/5/6

Feel forces, sensitivity all OK. Pitch response: better than the previous case. Still unstable and requiring attention, but it didn't seem to try to get away as quickly. Airspeed control was not as much of a problem. Maintaining glide slope is a 5 on the ILS. Visual: no lateral maneuvers required. Pitch control certainly no more difficult than the ILS, also a 5. Flare-touchdown however, is a 6.

RUN 86-B PR: 6/6/6

Effect of turbulence made the job more difficult, of course. ILS glide-slope portion is a 6. Visual is a 6. We had some lateral maneuver to make. The flare-touchdown is also a 6.

RUN 86-C PR: 7/7/7

Effect of heavy turbulence just is continually destablizing. The ILS portion will be a 7. The visual a 7, and touchdown a 7.

DATE-RUN: 5/6/80-87 PILOT: A CONFIG: S46A

RUN 87-A PR: 6/7/8

Forces, sensitivity, directional still OK. Pitch response: very noticeably less stable than in the previous case and has PIO potential. Required continual counter-type inputs to damp out the runaway-pitch. However, I was able to maintain the glide slope fairly well. The airplane did not seem to chase around with vertical speed, even though the pitch was bouncing around. ILS portion is a 6. Visual, for some reason, was more difficult. Visual is a 7. Flare-touchdown: appeared, as we were trying to flare, we were getting into a very definite PIO and it was quite a struggle to get it set down. I am not sure how it really turned out. But the touchdown will be an 8. [Pilot, since he can not feel touchdown impact, is "not sure how it really turned out" - assumes recorded sink-rate will tell.]

RUN 87-B PR: 7/8/9

Turbulence was very definitely destablizing. ILS glide-slope portion was a 7. Visual appeared again more difficult and it was an 8. We had a little problem with the visual system on the flare-touchdown, but it appeared as we were getting into the same kind of PIO we had before, and it will be a 9 for the flare-touchdown.

RUN 87-C PR: 7.5/9/10

Effect of turbulence just continues to degrade the situation, and I have kept changing my mind on the way down on the ILS portion whether it is a 7 or 8, so I'll call it a 7-1/2. The visual portion deteriorated considerably, with PIO tendency of rather severe proportions, to a 9. It looked like the flare-touchdown portion was pretty much unpredictable in the PIO, and I will call it a 10.

DATE-RUN: 6/6/80-90 PILOT: R CONFIG: AF4

RUN 90-A PR: 2/2/2

Done in smooth air, with no augmentation failures. It looked like a very good airplane. Feel forces were OK. Sensitivity, seemed alright. Lateral-directional was OK. No particular problems. Didn't see any PIO tendencies or require any special technique. Airspeed control was good. Didn't have any trouble acquiring the glide slope or maintaining the glide slope. The rating is a 2 for the glide slope. The visual was also good. Nothing unusual about it. I didn't make any big lateral inputs, but consider that the visual and instrument portions of it were about the same. Rate visual as a 2. Flare-touchdown was also in that category. No tendency to porpoise or over- control. A relatively good airplane.

RUN 90-B PR: 2.5/2.5/2.5

Was conducted with moderate turbulence. No particular problem with it. Everything went off pretty well. I would put it at a 2 1/2 for each one of the conditions, for the ILS, visual and landing. I landed just a little bit long - I broke out slightly high, but nothing difficult about getting the airplane down.

RUN 90-C PR: 2.5/3/3

Was with heavy turbulence. Acquiring the glide slope on instruments didn't present any particular problem. I noticed that when we broke out visually, I don't know if it was the effect of the turbulence or not, but there was a tendency to zoom a little bit just before we crossed the end of the runway, I ballooned quite a bit, and had a little trouble getting the airplane back down in the place I wanted on the runway. But it didn't result in any over-controlling or anything like that. It was just a random gust or something that took me up. I would put the visual and the landing at about a 3. Just because it was different than what I had seen before, but probably just due to the degree of turbulence. [Pilot rating of 2.5 for ILS portion comes from test engineers notes, presumeably from pilot after formal comments.]

DATE-RUN: 5/6/80-91 PILOT: R CONFIG: S42A

RUN 91-A PR: 6/6.5/6.5

Was in calm air with a stability augmentation failure. Feel was OK, sensitivity was OK, but the airplane was very definitely unstable in pitch. I had to spike conditions, if it took off in one direction or the other, to keep from pitching up or pitching down into a stall or into the ground. It didn't create any, what I call, PIO tendencies, but it did require overriding inputs to stop the pitch up or pitch down. In other words, just a spike on it seemed to stop it, and you could usually stop it in one overshoot or less. This higher workload on pitch made airspeed control just a little more difficult. I acquired the glide slope OK, but it required a higher workload and this showed up on the lateral also, lateral-directional being a little harder to pin down because of the difficulty in maintaining an attitude for glide slope. However, I got the airplane down reasonably close on the glide slope. I would probably put it at about a 6 under ILS conditions. I would go about a 6-1/2 visually. The main reason, there, is pitch control is again something that has to be

treated lightly because large inputs have a tendency to get out of hand easily, but with small inputs, the airplane can be gradually lowered down to the runway. Again lateral maneuvering does aggravate this pitch tendency. I would say that the biggest difference between the visual and ILS is the tendency to want to make larger inputs under visual conditions. You just have to refrain from doing that. I would make the visual and the touchdown about a 6-1/2. I tended to be a little bit long on the touchdown, but is was mostly becuause of making smaller inputs, working my way down a little more slowly than I would in a good configuration.

RUN 91-B PR: 7/7.5/7.5

Was conducted three different times. The first two times I wasn't able to perform what I call a satisfactory landing, and I had the impression there was some kind of offset initially set up on it. The third time, the run worked out OK, and looked fairly reasonable for moderate turbulence. There is a tendency for the airplane to want to pitch up or down, depending on how you let it go with an input, and the sensitivity seems to be a little on the low side or sluggish side, most noticeable after you break out VFR. I would tend to give a 7 to the ILS portion of it in turbulence, just because of the workload increasing. I would go 7-1/2 on the visual part of it because of the requirement to try to keep the inputs down small. I put the landing at a 7-1/2. I guess I had the impression that there was something different about the setup on the first two runs that I didn't see on the last run, but I can't say what it is.

RUN 91-C PR: 7/6/6

Was with heavier turbulence, but I can't say that I see a lot of difference there. I would leave it at 7 for the ILS. Visual and landing at 7-1/2. They both worked out alright. We didn't see that offset again on that last setup until after break out, which was normal. I think there might have been an input on the previous runs that was different, but it didn't have a big influence on the outcome of the condition.

DATE-RUN: 5/6/80-92 PILOT: R CONFIG: S43A

RUN 92-A PR: 5.5/5.5/5.5

The airplane was unstable in pitch, but it seemed like it was just responding more slowly in terms of a pitch up or a pitch down, and I seemed to be able to control the tendencies for it to want to pitch either way a little easier. Lateral-directional didn't seem to give me any particular trouble. Airspeed control was a little easier. The workload didn't seem to be quite so high with this configuration for some reason. No tendencies to porpoise, but it took a special over-control or a spike to stop the tendency when it wanted to pitch. The acquiring of the glide slope was reasonably good. I would probably go about a 5-1/2 on it. Visually, I didn't see anything any difference, and on the flare and touchdown it was also in about the same category. I didn't seem to be as conscious of over-controlling with this configuration as I was on the last one.

RUN 92-B PR: 6.5/6.5/6.5

Was with moderate turbulence. The biggest problem I see is that it is a little more sluggish than before. It takes more stick displacement to get a response. However, the response can be damped out in terms of trying to over-pitch, pitch up or pitch down, quite easily. It is just a little slower responding. The first run I made under this condition, I broke out a little far to the left and I had a little trouble getting back to the runway, and I decided to go around. The second one was satisfactory and I was able to go ahead and land. I would go about 6-1/2 on all three. I found that it is necessary to keep the inputs down, not make too big inputs, either IFR or VFR. I didn't have any serious problems on the flare and touchdown, so I would leave then all at 6-1/2.

RUN 92-C PR: 6.5/7.5/8

Was with heavy turbulence. The IFR portion of it is still on the order of 6 1/2 or so. It seems to work out pretty good. But when we get visual and start to work the problem of getting the airplane down close to the runway, I start finding it more difficult to do in this heavy turbulence and I did find myself using full control momentarily a couple of times in both directions because of the sluggishness of the airplane. But, you can spike it and stop these inputs without any overshoot tendencies. I would go to a 7-1/2 on the visual, and about an 8 on the landing. I felt like I just happened to be on the right cycle, as far as coming down was concerned, on that landing and got away with it, but it required fairly high workload right at the last.

DATE-RUN: 5/6/80-93 PILOT: R CONFIG: S44A

RUN 93-A PR: 6.5/6.5/6.5

Was in smooth air, again had an augmentation failure. I got the impression the airplane is getting more sluggish in response to stick inputs. It is unstable. It takes larger inputs to stop the pitch-up or pitch-down, whichever way it wants to go. But it can be spiked and stopped rather abruptly, as long as the inputs are small it doesn't seem to get out of hand. I guess I don't like the sluggishness quite as well as the previous configuration. I tend to think it is a little too much in the way of stick motion to get the response you need. I am going to go about 6-1/2 on the configuration for all three: ILS, visual, and flare and touchdown. In smooth air, it seems like the job is not too difficult. The flare and touchdown, I purposely let the airplane float along so I wouldn't have to make any inputs, and it did touch down a little on the long side so we overshot the touchdown point somewhat, but I was a little bit reluctant to put an input in, knowing that it probably would be difficult to reduce the sink-rate for the landing if I did. I'll go 6-1/2 on all three ratings.

RUN 93-B PR: 7.5/8/8

The turbulence has a tendency to create a higher workload and makes the airplane a little slower in response to correct for getting back to the glide slope. The sluggishness seems to show up even more. I would go about a 7-1/2 on the ILS because of the higher workload and the sluggish response. I would go about an 8 on the visual and the landing. Again, the landing was quite long because of having to make very small inputs.

Turbulence seems to aggravate the ability to touchdown accurately. As long as I kept the input small, I was able to control the sink-rate reasonably well to get a touchdown, but it was quite a ways down the runway and the response to the stick inputs is quite sluggish.

RUN 93-C PR: 7.5/8.5/9

Was with heavier turbulence. The sluggishness again does not really show up as much on the IFR as it does under VFR conditions. I would stay at 7-1/2 as far as the ILS tracking and all is concerned. However, under visual, I ran into more difficulty, in terms of making larger inputs and then not sure I could correct in time to keep from hitting. I thought I was going to be short on the landing, needed full control, full nose-up control, to keep from landing short. This resulted in a fairly substantial balloon that ended up with a very long landing. I would go to 9 on the actual landing and 8-1/2 on the visual because of the sluggishness. It is very slow to respond now.

DATE-RUN: 5/6/80-94 PILOT: R CONFIG: S41A

RUN 94-A PR: 8/8.5/8.5

Was conducted in smooth air. The forces are OK, but sensitivity, or I should say the response of the airplane, is different. Tendency to porpoise as a result of inputs, especially when they get large. It is hard to stop the tendency to pitch up or pitch down. The airplane is definitely unstable in pitch, it will go either way depending on the input. This makes airspeed control, as well as controlling the glide slope, quite difficult. I would put the glide-slope acquisition at about an 8. Just trying to maintain it is a big workload. Visually, the tendency to want to get in more elevator makes it a little difficult to stop the pitch from porpoising if I made bigger inputs. I was able to get it close to the runway, but it resulted in a very long touchdown because of having to cycle the stick so many times to damp out the tendency to want to go in hard. I would put the landing and visual at 8-1/2.

RUN 94-B PR: 8.5/10/10

Was with moderate turbulence. We were able to control the airplane on instruments reasonably close on the glide slope, but there is a lot of cycling of the column to prevent porpoising. I would go an 8-1/2. As soon as we broke out, we started running into troubles in maintaining a reasonable flight-path angle or glide slope to touchdown, and ended up crashing on the runway due to a cycling in pitch that I couldn't stop. I would give it a 10 on the visual and the actual landing. The visual is OK, at higher altitudes, where you have more altitude to round out the airplane in some of these cycles it gets into, but at the altitudes of 200 feet or less, there is just not time to prevent hitting the ground, I would say, under these conditions of turbulence.

RUN 94-C PR: 9/10/10

Was with heavy turbulence. The airplane was very unstable and difficult to maintain the glide slope. We did maintain it reasonably close until we got down close to VFR. When we broke out, it was obvious that there were cycles going on that were not possible to control under VFR conditions, and we ended up hitting the ground before we could get up

to the runway. I would call it a 9 on the instrument approach under heavy turbulence, and a 10 and a 10 under visual.

DATE-RUN: 5/6/80-95 PILOT: R CONFIG: S45A

RUN 95-A PR: 6/6/6

In smooth air. The airplane is not quite as sluggish in feeling as I have seen on some of the other configurations, although there is a failure mode of some kind. Not too difficult to fly on the glide slope on instruments, but I didn't have any real tendencies to PIO or anything like that, but it is unstable and just small inputs in the opposite direction will stop the pitch up. We ended up having to repeat this run a couple of times because of some unusual things we saw in the visual, but the last run worked out quite well. I guess I would put the ILS at about 6. There were no disturbances when we broke out, and I didn't have any trouble getting the airplane down. I would leave it at a 6. The main thing is the airplane is unstable in pitch, but the tendencies to over shoot in pitch, either up or down, can be stopped with small inputs on the stick.

RUN 95-B PR: 6.5/6.5/7

Was with some turbulence. No particular over-controlling tendencies in the turbulence. No real porpoising noticed. I can get reasonably close to staying on the glide slope. I would give it a 6 1/2. On the visual, it is a 6 1/2 - nothing unusual about that. It doesn't take large inputs to make corrections for tending to pitch up or down, even though it is unstable. On the landing portion of it, I noticed that I apparently leveled off a little bit high. After cutting my thrust, I expected the airplane to just sink on in, but it just floated along the runway for awhile and used up quite a bit of runway before touchdown. I would go to about a 7 on the landing. Because of that, we will take another look at the higher turbulence to see if that is a factor.

RUN 95-C PR: 6.5/6.5/6.5

Was with heavier turbulence. That time everything looked reasonable. I guess I didn't see anything that bothered me at all. I would go abcut 6-1/2 for ILS, visual and landing. I didn't notice that floating tendency this time that we had on the previous run. The control response is good enough that you can stay away from PIO's. You don't need a lot of large corrections. There is no sluggish effect to it, and it looks like it can be handled reasonably well in turbulence.

DATE-RUN: 5/6/80-96 PILOT: R CONFIG: S46A

RUN 96-A PR: 9/10/10

Smooth air. I found again the airplane is unstable. Sensitivity is slightly on the low side, so I found myself in a porpoising condition most of the time trying to find the glide slope. I never did acquire the glide slope. I went through it several times, but I was in a PIO most of the time and never did really break out to the point where I could get any visual chance to fly the airplane. I would put the ILS portion of it at about a 9, and the visual and landing, of course, we never accomplished. A 10 for visual and landing, mostly because I just didn't have control ofthe airplane when I got down to lower altitudes. Its PIO tendency,

caused by tendencies to overshoot one way or the other, either up or down in pitch, and not being able to stop the PIO tendency with a reasonable amount of control input. Even under instrument conditions, I noticed I was getting close to full control column travel.

RUN 96-B PR: 9.5/10/10

Done with turbulence. I again had trouble staying on the glide slope. I could acquire it for just very short periods of time and then it would depart from it again, pitching either up or down. The airplane is very unstable. I could stop the pitch excursions with maybe just one spike on the stick, but the airplane departed from the desired attitude very quickly. I never did feel that I had control of it. Airspeed was responding somewhat to these pitch changes, but I couldn't do much about trying to keep it constant. Again I would say that the ILS portion of it, I'd put it around a 9-1/2 if I had to, because I managed to get down to visual conditions. But just as I got visual, I was conscious of it pitching down very rapidly and I made a pull up that resulted in over-controlling and then pitching back down into the ground short of the runway, so we never did accomplish the landing. It is a 10 airplane as far as VFR and landing is concerned. I am sure that if I were able to get a stable condition as I came out of the overcast, I would still have trouble trying to get it on the runway because of the rapid response in pitch that I was getting, and the inability to really get it stabilized for any given period of time.

RUN 96-C PR: 10/10/10

[Based on 96-B, the airplane in heavier turbulence was judged to be solidly a 10 airplane without the need to make the run.]

DATE-RUN: 5/7/80-90 PILOT: A CONFIG: AF4

RUN 90-A PR: 3/3/3

Forces, sensitivity, directional control are OK. Pitch response: no problems, no PIO tendencies, seemed reasonably stable. Little bit of, perhaps, reluctance to get the response that I was looking for with a pitch change. Maintaining glide slope is a 3. Visual, about the same, a 3. Flare-touchdown also a 3.

RUN 90-B PR: 3/4/4

The effect of turbulence was more noticeable to the visual, it seemed, than to the ILS portion. The ILS will stay a 3. The visual a 4. Flare-touchdown a 4. Also, the lateral maneuver did seem to be a bit destablizing as far as what I was trying to do.

RUN 90-C PR: 5/6/7

The effect of turbulence was very noticeable in that the vertical speed was moved around a lot and it took fairly significant pitch changes to control it, which made controlling the glide slope quite difficult. Call the ILS glide-slope portion, for the heavy turbulence, a 5. The visual was, if anything, somewhat more difficult. I would call it a 6. And the flare-touchdown, I just didn't feel that I could put it exactly where I wanted it, to make the kind of landing I wanted. It just didn't seem to do what I wanted it to do, and I will call it a 7.

DATE-RUN: 5/7/80-91 PILOT: A CONFIG: S42

RUN 91-A PR: 6/5/5

Forces, sensitivity, directional all OK. Pitch response: very noticeable instability. Airspeed control was somewhat of a problem, but it seemed to be on the previous set also. It didn't seem to be aggravated too much. ILS glide-slope acquisition was quite difficult. It is a 6. Visual this time seemed easier. No lateral maneuver was required and we were pretty well established, so that may have contributed to it. Its a 5. Flare-touchdown also seemed to work out fairly well, considering the problems. It is also a 5.

RUN 91-B PR: 6/5/5

Effect of turbulence was noticeable but didn't really seem to degrade the situation that much more than it already was. The ILS glide-slope portion was a 6. The visual again seemed a little easier and it is a 5. The flare-touchdown is also a 5.

RUN 91-C PR: 7/6/6

Effect of heavy turbulence began making a very noticeable difference in this part. The ILS portion - there were portions of it that I could not keep within the desired parameters. It is a 7. Visual again seemed slightly easier, and I was actually able to recover a little bit from being a little bit out of shape on the ILS. It is a 6. Flare-touchdown is also a 6.

DATE-RUN: 5/7/80-92 PILOT: A CONFIG: S43

RUN 92-A PR: 4/4/4

Forces, sensitivity, lateral-directional all OK. Pitch response: there was a noticeable instability that had to be constantly countered, but after you quickly get the hang of it, it didn't seem to present any real problem maintaining glide slope at all. The vertical speed pretty much stayed there. The little bit of pitch excursions were easily overcome and the glide slope was really no problem, considering the instabilities. I'd call the ILS glide-slope portion a 4. Visual was even easier. At least for what we saw with no upsets, and also there was very little lateral maneuver or pitch maneuver required, the visual would be a 3. The flare-touchdown pretty much went where I wanted it. I would call it a 3 also. With respect to the visual and the flare-touchdown that we just called a 3, the 3 was based primarily on the compensation required. However, considering the deficiencies, both would have to be 4's, but they are certainly good 4's.

RUN 92-B PR: 5/5/5

The effect of turbulence was noticeable. However, even though the pitch required more attention to keep it where you wanted it, the vertical speed seemed to be more or less unaffected by it, or independent of it, and we were able to plow through the turbulence without much additional workload as far as maintaining the glide slope. Keeping the pitch excursions from getting out of hand was noticeably more difficult, and we will call the ILS a 5. The visual seemed about the same, and the flare-touchdown also the same. Visual is a 5; flare-touch down a 5.

RUN 92-C PR: 5/5/5

Effects of turbulence were noticeable. There were some up and down drafts that were encountered which required a little more workload to counter them with power and so forth. But the over-all task for the ILS is still a 5, the visual and flare-touchdown a 5.

DATE-RUN: 5/7/80-93 PILOT: A CONFIG: S44

RUN 93-A PR: 3/4/4

Forces, sensitivity, lateral-directional all OK. Pitch response: no particular problem at all. Airplane appeared basically stable and responsive. Airspeed control was kind of a nuisance because there didn't seem to be any speed stability at all. You had to keep an eye on the airspeed all the time. As far as handling the airplane and making it fly down the glide slope, it just did whatever it was supposed to do without any problem at all. Maintaining glide slope is a 3. The visual seems somewhat more difficult this time for some strange reason. Perhaps due to the lack of speed stability, it got a little bit strange feeling. I call the visual a 4 and the flare-touchdown a 4.

RUN 93-B PR: 4/5/5

The effect of turbulence was noticeable on the pitch but maintaining glide slope wasn't that much more of a problem. Call the ILS portion a 4. The speed instability was noticeable, and that perhaps contributed to some of the aggravation. Again the visual seemed a little bit more difficult than the ILS, and the lateral maneuver was also somewhat complicating. Visual is a 5 and flare-touchdown is a 5.

RUN 93-C PR: 5/6/6

The effect of turbulance just continues to degrade the situation. The ILS portion is a 5. Visual, again harder than the ILS portion, it's a 6. Flare-touchdown is a 6. Also, it should be noted there is a PIO tendency in the visual and the flare-touch down that is noticeable but controllable.

DATE-RUN: 5/7/80-94 PILOT: A CONFIG: S41

RUN 94-A PR: 6/6/6

Forces, sensitivity, directional all OK. Pitch response: very definite instability and with a lot of PIO potential. Airspeed control takes attention but is not as difficult as previous. It takes constant quick small movements of the control column to dampen out the pitch instability. Maintaining the glide slope can be done within desired parameters, but it is definitely a 6. It takes every thing you got to do it. Visual seems possibly a little bit easier, but I will call it also a 6 and the flare-touchdown is a 6.

RUN 94-B PR: 7/6/6

The effect of turbulence made flying the ILS more difficult and it is just not possible to stay within the desired parameters continuously. The ILS portion will be a 7. Visual did seem easier, and we were able to accomplish the lateral maneuver and get the thing back in shape and make a reasonable landing. Visual will be a 6 and flare-touchdown is still a 6.

RUN 94-C PR: 7/7/7

The turbulence just continues to degrade the situation, but over all the problems are essentially as described previously. The ILS portion is a 7. Visual a 7. Flare-touchdown a 7.

DATE-RUN: 5/7/80-95 PILOT: A CONFIG: S44B

RUN 95-A PR: 5/6/7

Forces were OK. Sensitivity seemed low compared to previous runs. Lateral-directional was OK. Pitch response: very sluggish in that it took large control inputs to move the pitch, however, the pitch excursions were relatively easily controlled once that was understood. Airspeed didn't seem to be too much of a problem. ILS glide slope was difficult, but a 5. Visual seemed harder because the pitch just didn't seem to want to respond with what would seem like a normal control input and made it feel very sluggish. Visual is a 6, and the same tendency in the flare and touchdown was even more difficult and it was a 7.

RUN 95-B PR: 5/7/8

The problem associated with turbulence is noticeable, but the actual compensation required to maintain the glide slope is perhaps no more difficult in terms of workload than some of the other types of cases, except this one is just something I really don't like, but it's still a 5 in terms of the ILS glide-slope portion. However, the difficulty in the visual is much more pronounced with the turbulence. It is a 7 and the flare-touchdown is an 8.

RUN 95-C PR: 7/8/9

The effect of turbulence really magnifies the undesirable characteristics of this particular configuration. The ILS portion is a 7 and visual an 8. Flare-touchdown is a 9. The significant thing seems to be that the pitch excursions and the pitch motions due to the basic instability and the gusts and some of the other things seemed to really be rather rapid, and the response due to controls is very sluggish, so you tend to really be behind the problem and just run out of capability to do something about it.

DATE-RUN: 5/7/80-96 PILOT: A CONFIG: S45

RUN 96-A PR: 4/3.5/4

Forces, sensitivity, lateral-directional all OK. Sensitivity is good, back up to what is normal. Pitch response: the same kind of instability as in the previous is noted, as far as the tendency of the aircraft to just go away from where you want it, but it is real easy to catch and put back. It responds well. Airspeed control is a little bit of a problem. Maintaining glide slope was pretty straight forward with a moderate compensation. It's a 4. The visual actually seemed easier, from the compensation required to put the airplane where you want it, and for that it would probably be a 3-1/2, and we'll call it that. The flare-touchdown is just a shade more difficult than the basic visual so it will be a 4.

RUN 96-B PR: 5/4/4

The effect of turbulence made the problem of continually damping out the unstable pitch more of a nuisance. The ILS glide slope will be a 5. Visual again is still easier. Lateral maneuver was no real problem. It would be a 4. The flare-touchdown, in spite of having to damp out the pitch instability, is still a 4.

RUN 96-C PR: 5/4/4

The effect of turbulence was noticeable, but it still didn't tend to degrade the situation all that much more. ILS portion remains a 5. The visual is a 4. I was actually able to recover a little bit from being somewhat out of shape on the ILS. Flare-touchdown is also a 4, really was not that much of a problem.

DATE-RUN: 5/7/80-97 PILOT: A CONFIG: S46

RUN 97-A PR: 6/6/6

Forces, sensitivity, directional OK. Pitch response: very noticeable instability with PIO tendency. It required constant, quick pitch inputs - quick small pitch inputs to dampen out the pitch. Airspeed will be a little bit more (difficult?). Glide slope was very difficult - continually attended to maintaining the pitch attitude - that would be a 6. Visual was different, but same level of difficulty, is a 6. Flare-touchdown is also a 6. (I was) continually working to keep the pitch attitude under control, but the flight path was controllable.

RUN 97-B PR: 6/6/6.5

The effect of turbulence was noticeable in bouncing the pitch around, but it didn't seem to make the basic problem controlling pitch or flying the whole airplane any more difficult. It's just that the turbulence bounced it around as well as the stick inputs. It took essentially the same effort to keep it under control as it did without turbulence. The effect on flight path was really minimal. ILS glide-slope portion is a 6. Visual is about the same, a 6, and the flare-touchdown - a little more of a PIO tendency this time for some reason - a 6-1/2.

RUN 97-C PR: 6/6/6.5

Effect of heavy turbulence again doesn't seem to degrade the basic problem any more than it was without turbulence. Turbulence is noticeable, but you have more of a problem with the basic instability than you do fighting the gusts. They don't seem to add that much more to it. ILS portion is still a 6. Visual is still a 6, and the flare-touchdown a 6-1/2.

DATE-RUN: 5/8/80-49 PILOT: T CONFIG: AFO

RUN 49-A PR: 2/2/2

Inbound sector: the feel forces were normal in roll; the pitch forces are slightly more sensitive. Sensitivity was OK, no problem. Lateral-directional was OK. No problem with pitch response. No PIO tendency and no special inputs were required. Airspeed control, no problems. ILS glide-slope acquisition was normal - it was gradual and easily controllable. Maintaining the glide slope was no problem. I'd

give ILS a rating of 2. Visual: pitch control was good - no problem. Lateral maneuver was easy. I transitioned to the runway centerline easily. Visual seems a little easier in pitch control than when on instruments. I would still give the visual a 2. Flare and touchdown: I noticed that the airplane seems to flare OK, but to touchdown you have to ease forward on the stick slightly. Flare-touchdown also considered to be a 2.

RUN 49-B PR: 2/2/2

The effect of turbulence - the airspeed seemed to oscillate fairly regularly about the actual airspeed. Lateral maneuver, no difficulty. Turbulence did seem to affect the pitch response slightly, but the airplane was easily controllable throughout the ILS, the visual, and the flare and touchdown maneuvers. There would be no rating change for Run B. Rating is 2 for the ILS, the visual, and the flare and touchdown.

RUN 49-C PR: 2/2/2

The effect of turbulence was mainly in airspeed oscillations. They were larger. During the latter part of the run the airspeed decreased considerably, requiring a higher pitch attitude to maintain the glide slope. The airplane responded well in pitch in spite of the turbulence, so the turbulence was not affecting the pitch stability of the airplane. I would consider the ratings to remain the same - a 2 for the ILS, visual, and flare and touchdown. The increased pilot compensation was due to turbulence rather than aircraft deficiencies.

DATE-RUN: 5/8/80-50 PILOT: T CONFIG: AF4

RUN 50-A PR: 1.5/1.5/1.5

Feel forces were OK. Sensitivity in pitch seemed to be decreased slightly. The lateral-directional remains the same. No problem in pitch response. No PIO tendency, and no special inputs were required. The airplane seemed to be slightly more stable in pitch response, and seemed to be a little more comfortable airplane to fly than runs 49. There were no problems with airspeed control; it was very good. Glide-slope acquisition was smooth, it was easy. Maintaining the glide slope was actually slightly easier than Run 49. It was a more desirable airplane pitchwise to me than the previous airplane, and it flys somewhere between a rating of a 1 and a 2. The visual maneuver was easy to maintain pitch control. I'll give it a rating of 1-1/2 for the ILS. Visual, 1-1/2. Lateral maneuver on the visual, I was slightly off the runway centerline, made the correction easily. The visual maneuver is just as easy as the ILS. Flare and touchdown, I'd give it a rating of 1-1/2. It was easy, required the same type of response as previous airplane - a slight easing forward of the stick to cause the airplane to touch down.

RUN 50-B PR: 2/2/2

The turbulence seemed to affect the airspeed only, and did not seem to affect the pitch response. The pitch response was good, when I wanted to make a change and correct back to the glide slope, the airplane did not overshoot the desired pitch attitude that I wanted. The lateral maneuver was approximately the same. During the visual portion and the flare and touchdown, the turbulence didn't seem to affect how - the airplane

responded slightly. I would give it a 2 for the ILS, the visual and the flare-touchdown.

RUN 50-C PR: 2/3/3

The main effect of turbulence was in airspeed changes; it didn't seem to effect the lateral or the pitch response of the airplane. The airspeed initially sheared to greater speeds, and then sheared below 145 knots. The ILS portion I would still rate a 2. Because of the wind sheers and the airplane response, I would rate the visual and the flare and touchdown as a 3. It did require some pilot minimal compensation to get the desired performance that I wanted out of it, but it was no drastic change.

DATE-RUN: 5/8/80-51 PILOT: T CONFIG: F1

RUN 51-A PR: 3/4/4

The feel forces were the same in pitch and roll. The pitch sensitivity was changed. You would make a pitch input and the plane tended to overshoot the pitch attitude you desired. Lateral-directional remained the same - it was OK. The problem with the pitch response was the tendency for the pitch attitude to overshoot the desired input that you wanted. There was no PIO tendency. No problem with airspeed control. Glide-slope acquisition required greater amount of pilot compensation as well as maintaining the glide slope. ILS rating a 3. Visual: airplane pitch control seems to be slightly more difficult when you get on the visual and during the flare and touchdown, so I am rating the visual and the flare and touchdown a 4. The lateral maneuver seemed to be the same as the basic stable airplane, but the pitch was more difficult than the ILS, and so I rate the visual and the flare and touchdown as a 4.

RUN 51-B PR: 4/4/4

The turbulence affected the airspeed mainly, which caused a change in pitch attitudes more often throughout the ILS, through the visual and flare and touchdown. Lateral maneuver remained the same. I am going to rate the ILS, the visual and the flare and touchdown all as a 4. The main effect of the turbulence was to require greater pitch changes to compensate for the airspeed changes as I tried to track the glide slope of the ILS. Overshooting of the desired pitch attitudes was accentuated slightly because of the turbulence. This is why the ILS portion was downgraded to 4.

RUN 51-C PR: 7/10/10

Turbulence affected both the airspeed - increases and decreases in airspeed as well as vertical shears - which required large pitch changes to attempt to maintain the glide slope. The ILS portion I rate as a 7. I was not able to maintain the desired performance limits on the ILS, but I still had the aircraft in control. During the visual and flare and touchdown, we lost control of the airplane so it is rated at 10 for the visual and touchdown. I attempted to stair-step the pitch inputs to get the desired pitch angle that I wanted and needed, and the airplane did not respond quick enough, and when it did respond it began to overshoot and then I got into a PIO twice. There was a re-run on this and both times the airplane was out of control during the visual and the flare and touchdown.

TEST ENGINEERS NOTE:

This run was carefully examined and analyzed to see why Pilot T could not avoid a bad PIO (twice!) in the final flare and touchdown. No discrepancies could be found, and the calibration records checked out. Note that he had little trouble with identical conditions in 5/80/80-55-T. The only difference found was Pilot T's reference to "attempted to stair-step the pitch inputs" in this run.

DATE-RUN: 5/8/80-52 PILOT: T CONFIG: F4

RUN 52-A PR: 4/4/4

Forces remain the same. Sensitivity in pitch was - the airplane was less stable in pitch than the basic airplane. Lateral-directional remained the same. There was no PIO tendency in pitch. Special inputs: required greater pitch inputs to get to and keep the desired pitch attitude than the basically augmented airplane. No problem with airspeed control. Glide-slope acquisition was a 4, as well as maintaining the glide slope, a rating of 4. Visual - pitch control: the airplane was controllable in pitch without undue pilot compensation. I am rating it a 4 because I would like to see the airplane improved. It warrants improvement. It is somewhere between minimial and moderate pilot compensation for the pitch control. The lateral maneuvers remain the same on the visual. The visual appeared to be about the same as far as difficulty as the ILS portion. The flare and touchdown was controllable, but requires some improvement. I am rating that 4 also.

RUN 52-B PR: 5/5/5

The turbulence affected the airspeed as well as the vertical shears, and the lateral maneuver remained unchanged. I am going to rate the ILS, visual, and flare and touchdown as a 5 because there is greater pilot compensation required to get the airplane up to the desired pitch attitude to compensate for the turbulence.

RUN 52-C PR: 7/9/9

The turbulence downgraded the performance on the ILS. I rate the ILS portion a 7. The first portion of the ILS - three-fourths of the ILS - I was able to keep it pretty much within desired performance parameters, but the last portion I ran into a large down shear and I could not keep it within desired limits. The visual maneuver required maximum pilot compensation and I did not keep it within the desired limits that I wanted, so I am going to rate the visual and the flare and touchdown as a 9.

DATE-RUN: 5/8/80-53 PILOT: T CONFIG: F2

RUN 53-A PR: 5/5/5

Feel forces were normal, sensitivity was OK, lateral-directional was normal, was OK. Pitch Response: the airplane tended to wander and pitch more so than previous runs. There was no PIO tendency, but the special inputs was that I stair-stepped the stick and made more stick movements to get the desired pitch attitude that I wanted. Airspeed control was no problem. Glide-slope acquisition was normal, more compensation required because of the lessened pitch stability. Maintaining the glide slope required a greater effort. I am rating the glide slope as a 5. It required considerable compensation to maintain the desired limits, but controllability was no factor. The visual maneuver: the airplane was stabilized pretty much on centerline and glide slope and did not require any drastic pitch changes since it was already stabilized. It was about the same as the ILS. I am going to rate the visual and the flare and touchdown as a 5.

RUN 53-B PR: 6/6/6

The turbulence did seem to displace the pitch of the airplane slightly, but of course, because of the wind shears and changing airspeed, there was greater requirement for changing pitch attitudes throughout the ILS and the visual portion. I was able to keep it within acceptable limits most of the time throughout the ILS, visual and the flare and touch down so I am going to rate all three of them as a 6.

RUN 53-C PR: 7/9/9

The ILS was - I did not keep the airplane within desired performance limits using maximum pilot compensation, but I still had the airplane under control. During the visual and the flare and touchdown, required greater pilot compensation to keep it under control and I did reach the general region of the touchdown area of the runway, although I touched down shorter than I wanted to. During the flare maneuver, I used a full forward stick - for up to, it seemed like a second or longer - without getting any pitch response out of the airplane. I am rating the ILS 7 and the visual and flare and touch down maneuver as a 9.

DATE-RUN: 5/8/80-54 PILOT: T CONFIG: F6

RUN 54-A PR: 4/4/4

The feel forces were normal, sensitivity OK, lateral-directional OK. Pitch response: seemed to respond better than Run 53, did not seem to overshoot the desired pitch attitudes. No PIO tendency. Special inputs:

just requires greater stick activity to keep the pitch attitude where I wanted it. No problem with the airspeed control. There was some light turbulence initially, but it was taken out during the run. The glide-slope acquisition was normal. Maintaining glide slope required about a level of 4 - moderate compensation. I would like to see it improved because the airplane pitch does change somewhat without pilot inputs, that is why it is in the 4 category where it need improvement. The pitch control remains the same during the visual and the flare and touchdown as it did on the ILS. Lateral maneuvers were no more difficult. The difference from the ILS - I didn't see any. The flare and touchdown I'd also rate as a 4. So ILS, visual and flare and touchdown are rated 4. Nothing unusual in the flare and touchdown, the airplane was controllable throughout.

RUN 54-B PR: 5/5/5

The turbulence was nothing special. It just oscillated the airspeed and there was some wind shear. No effect on the lateral maneuver, and I am rating the ILS, the visual and the flare and touchdown as a 5 because it requires greater pilot compensation to get the same performance levels.

RUN 54-C PR:5/5/6

The turbulence accentuated the control inputs. The ILS and the initial breakout I am still rating as 5, but the flare and touchdown I am rating as a 6 - required more effort to get the touchdown point that I wanted.

DATE-RUN: 5/8/80-55 PILOT: T CONFIG: F1

RUN 55-A PR: 2.5/2.5/2.5

Forces, sensitivity, lateral-directional seemed normal. No PIO tendency. No real problem with the pitch response. No special inputs. No problem with airspeed control. Glide-slope acquisition was normal. Maintaining the glide slope was no problem. I maintained it pretty much within desired limits. I will rate the ILS between 2 and a 3. The visual maneuver - pitch control was no difficulty. Lateral maneuver was normal. It was about the same difficulty as the ILS. I will rate the ILS, the visual, and the flare and touchdown as 2-1/2.

RUN 55-B PR: 3/3/3

The effect of turbulence - the pitch instabilities are more apparent with turbulence than without turbulence. I am downgrading the ILS, visual and the flare and touch down. I am going to rate them a 3 because it required just minimal compensation to get the desired performance out of it.

RUN 55-C PR: 4/5/5

The turbulence just increased the amount of compensation that I had to made for the lack of pitch stability. So I've down graded the ILS portion to 4, and the visual, and the flare and touchdown to 5. I consider it takes considerable amount of compensation to get the airplane down in the touchdown zone and to keep it on the desired glide path just prior to touchdown.

DATE-RUN: 5/8/80-56 PILOT: T CONFIG: L21

RUN 56-A PR: 1.5/1.5/1.5

The feel forces were normal for a fighter type airplane. Sensitivity was good. The airplane responded in pitch immediately to small pitch changes. Lateral-directional remains the same as previous runs; it was good. No problem with pitch response. No PIO. No special inputs. No airspeed control problems. ILS segment and glide-slope acquisition was easy. Maintaining the glide slope was easy. The airplane responded right away to pitch changes. I am going to rate the ILS, the visual and the flare and touchdown at 1-1/2. The visual: pitch control was good, lateral maneuver was easy. The visual seemed a little easier than the ILS itself, and the flare and touchdown was very good. I rate the whole thing a 1-1/2.

RUN 56-B PR: 3/3/3

I think the biggest difference I notice right away was the turbulence was displacing the pitch attitude of the airplane on a consistent basis, continually displacing it from its nominal value, although the airplane responded well to pitch inputs. It is something I hadn't noticed as much with the F-111 type simulations. I am going to rate the ILS, the flare and touchdown as a 3. It requires some pilot compensation, because the pitch is continually being displaced about its nominal value by the turbulence, and requires more pilot effort to keep the airplane on the glide slope and on a nominal visual glide slope and touchdown.

RUN 56-C PR: 5/6/6

I am going to rate the ILS portion as a 5, and the visual, and the flare and touchdown as a 6. It takes considerabe more pilot compensation to make the airplane perform, and at times during the flare and touchdown you are working just the basic control of the airplane as well as achieving your desired performance parameters. I was able to touchdown pretty close to my desired touchdown zone on the runway.

DATE-RUN: 5/8/80-57 PILOT: T CONFIG: L71

RUN 57-A PR: 4/4/4

The feel forces were about the same. The pitch seemed just the same sensitivity as Run 56. However, the angle of attack, or rather the pitch attitude, seemed to change for given stick inputs, seemed to wander greater amounts than it did for the previous runs. There is no PIO tendency, but it required more stick activity to keep the airplane at the pitch attitude I wanted. No airspeed control problems. Glide-slope acquisition was normal although it required more compensation to keep the airplane on the glide slope. I am rating ILS as a 4. The visual and lateral maneuvers the same. Pitch was controllable but pitch was wandering a little more than previous runs; about the same difficulty as the ILS portion. I am rating the visual, flare and touchdown as a 4.

RUN 57-B PR: 4/4/4

The turbulence did not displace the angle of attack and the pitch attitude of the airplane like it did in Run 56. The ILS required more effort, but I attributed it to the turbulence rather than the airplane stability. I am still going to rate to ILS, flare and touchdown as a 4.

RUN 57-C PR: 5/5/5

I am going to rate the ILS, visual and the flare and touchdown as a 5. The turbulence did not displace the pitch attitude like the previous runs, but there were greater pitch changes required due to the turbulence. The vertical sheers and airspeed changes and the pitch attitude tended to overshoot. Its tendency to overshoot was accentuated because of the turbulence and so the desired pitch angles were harder to obtain and required considerable pilot compensations. So 5 for all three segments.

DATE-RUN: 5/8/80-58 PILOT: T CONFIG: L72

RUN 58-A PR: 3/3/3

The forces remain the same. The sensitivity of the airplane, the pitch sensitivity, seemed greater than baseline airplane. The pitch tended to wander or change greater than the actual stick inputs, and then you had to go up and capture it and bring it back down to the pitch attitude you want. Lateral-directional was normal. No PIO tendency. It took more stick activity to get the pitch attitude you wanted. The ILS glide-slope acquisition was easy, it was normal, just took a little more stick activity. Maintaining the glide slope required minimal compensation because of this wandering of the pitch attitude. I am rating the ILS, visual, flare and touchdown as a 3. Lateral maneuvers on visual were no problem, they were normal. The visual was slightly more difficult. It could be in the mechanics of this visual simulation, because as I cross-checked the glide slope during the visual portion, I was seeing the need for a change in pitch attitude at a slower rate by using the visual clues than I did by using the glide-slope information (instruments). The flare and touchdown took a little more than normal, so I rate it all 3.

RUN 58-B PR: 3/4/4

I'm going to rate the ILS portion a 3. There was more effort required because of the turbulence, but the airplane responded quite well throughout it. The visual, and the flare and touchdown I am going to rate as a 4 because of the greater pitch displacements which were induced by the turbulence.

RUN 58-C PR: 3/4/4

The heavy turbulence did not seem to affect the control of the airplane any more than moderate turbulence. So I am going to keep the ratings the same, 3 for the ILS and 4 for the visual and flare and touchdown.

DATE-RUN: 5/8/80-59 PILOT: T CONFIG: L73

RUN 59-A PR: 3/3/3

The forces were OK. The pitch sensitivity seemed a little more sensitive than the basically stable airplane, but not as bad as I have seen in some of the previous runs. Lateral-directional was normal. There was no PIO tendency, and just slightly more stick input to keep the pitch attitude where I want it. No airspeed control problem. The ILS glide-slope acquisition was normal. It took minimal pilot compensation to keep the desired performance perimeters during the ILS, so I am rating the

ILS portion a 3, and the same for the visual, and flare and touchdown. No problem with lateral maneuver. Pitch control was good. I was going to land a little short, and I was able to control the pitch and get it down pretty much in the touch down zone. Visual seemed about the same difficulty as the ILS, so flare and touchdown are a 3 also.

RUN 59-B PR: 4/4/4

The turbulence accentuated the pitch instability slightly. It didn't have any effect on the lateral maneuvers. I am going to down rate it to a 4 for the ILS, the visual, and the flare and touchdown.

RUN 59-C PR: 5/5/5

I am rating the ILS a 5, and the visual and flare and touchdown a 5. I noticed the turbulence was causing greater excursions in pitch attitude than it did with the moderate turbulence; therefore, required more pilot compensation to try to keep the airplane on the glide slope within the performance perimeters and get it down in the touchdown zone.

DATE-RUN: 5/8/80-90 PILOT: R CONFIG: AF4

RUN 90-A PR: 2/2/2

With no turbulence. The configuration, feel, sensitivity, lateral-directional - all looked very good. No tendency for porpoising or over-controlling in any way. I would put the ILS under IFR conditions at a 2. Visual a 2 and landing a 2. Pretty good configuration. Nothing unusual about it at all.

RUN 90-B PR: 2.5/2.5/2.5

Was with moderate turbulence. I got a little bit high on the glide slope prior to breaking out but nothing unusual about it. The airplane is still easily controlled during the IFR portion and VFR portion. I would go maybe 2-1/2 in turbulence for all three modes. Nothing particularly different about it.

RUN 90-C PR: 3/3/3

Was with heavy turbulence and the workload was higher, it was obviously a little higher. I again noticed the tendency to get a little bit high on the glide slope, but was able to correct for it without too much trouble. Touchdown was not as accurate, but still reasonable considering the turbulence. I would go to about a 3 across the board on it. 3 for IFR, VFR, and the approach and landing.

DATE-RUN: 5/8/80-91 PILOT: R CONFIG: S42

RUN 91-A PR: 5/5/5.5

Without turbulence, was unstable airplane in pitch. The sensitivity seems to be reasonably good, but it is showing some negative static stability. There is a slight tendency for PIO, but it is easily damped just spiking the stick in one direction or the other to stop the pitch. Rather easy to control it, in smooth air anyway. Didn't have too much trouble acquiring the glide slope. I am not sure that it makes much difference in IFR or VFR. I think I would go for about a 5 on the IFR and VFR, and probably a 5-1/2 on the landing. The touchdown was reasonably

good, but I did notice a little tendency for porpoising as I was trying to get it to the touchdown point. But it is not too bad considering it is unstable.

RUN 91-B PR: 6/6/6.5

Was with moderate turbulence. The workload increased noticeably. I was having a little trouble staying on both the localizer and the glide slope. I broke out thinking I would need bigger corrections than I saw, so I must have taken advantage of an offset that might have been in there. The airplane does want to pitch up or down because of its instability. But I can stop the tendency to PIO, after maybe a couple of cycles on the stick, but I was having a little trouble trying to control the touchdown for landing. I would have to go about a 6, 6, and a 6-1/2 on the three areas. The main thing being the workload in pitch and the tendency for PIO. However, the stick sensitivity helps in terms of turbulence. It is not what I call a sluggish feel, and it responds quite readily, but there is a tendency to want to over-do it. Have to keep the inputs down a little bit lower in VFR, and on the takeoff and landing, but the airplane could be handled reasonably well close to the runway considering its configuration.

RUN 91-C PR: 6/6/6.5

Was done with heavy turbulence. I found that it is not a lot of difference than the previous run. It takes a little more effort to keep the airplane where you want it, but it responds reasonably good. The touchdown was long and slightly off centerline. I was having a little trouble getting the accuracy I wanted out of it, but I thought it was an acceptable touchdown. I would leave it at 6, 6, 6-1/2.

DATE-RUN: 5/8/80-92 PILOT: R CONFIG: S43

RUN 92-A PR: 5/5/5

Calm air. Again, it was an unstable airplane, but quite easy to handle, and reminded me very much of the previous configuration. No big differences. A slight tendency for PIO'ing, but I didn't have any trouble damping it out and making it respond to what was needed. I think I would go about three 5's. Nothing unusual about the IFR or the VFR - as long as the inputs were small, you could control it quite easily. But the airplane is unstable in pitch.

RUN 92-B PR: 5.5/5.5/6

Was with moderate turbulence. I had a chance to maneuver it a little more in the VFR conditions, but it didn't seem to destroy the ability to get reasonably close to the touchdown point. Ability to keep the airplane on the glide slope under instrument conditions, still pretty good. I would go 5-1/2. Probably 5-1/2 under visual and 6 for the landing. I was just a little bit short, on the firmside, but I still have reasonably good control of it considering it is unstable.

RUN 92-C PR: 6/6/6

Was with heavier turbulence. It didn't seem to create any problems for me under the IFR conditions or after breaking out, but I did notice during the attempt to flare and land that I got a pretty good bump from

turbulence, I'd guess, and ballooned a little bit, so we were long on touchdown. But I had reasonably good control of the airplane considering its condition. I would go probably about three 6's on the configuration. In other words, 6 for IFR, 6 for VFR and 6 for touchdown and landing.

DATE-RUN: 5/8/80-93 PILOT: R CONFIG: S44

RUN 93-A PR: 5/5/5

Was without turbulence. The airplane is still unstable. However, I got the impression sensitivity might have been reduced a little bit. It seems like I need a little more stick, now, to get a given pitch response out of it. But it still was rather easy to handle. I would go about three 5's. Nothing out of the ordinary required in the way of special inputs. Keep the control inputs down to small inputs and it is not too difficult to handle. The difference between IFR and VFR is negligible. Three 5's looks reasonable to me.

RUN 93-B PR: 5.5/5.5/5.5

With some turbulence. Again I have the impression of a little bit lower sensitivity, but still able to handle it reasonably well. The workload is up slightly. I would go maybe a 5-1/2 across the board. The VFR and the landing worked out reasonably well.

RUN 93-C PR: 5.5/5.5/6

Was with heavier turbulence. I can't say that I could see a lot of difference in the IFR with this turbulence level. I would leave it at 5-1/2 for the IFR and VFR. However, on the landing, I had a little more trouble getting it down. I would go to a 6 on the landing. Seemed to be just having to work a little harder, and again I feel the stick sensitivity might be accounting for it.

DATE-RUN: 5/8/80-94 PILOT: R CONFIG: S41

RUN 94-A PR: 7/7/7.5

Was without turbulence. Airplane is still unstable, but the tendency to porpoise is much more noticeable now, having trouble holding a pitch attitude. I could hold the glide slope quite easily, but there was a tendency for the PIO all the time. Never really could get it trimmed out or get settled down on a given attitude to hold flight path. I would, under VFR conditions and IFR conditions, it was similar in that respect, I would go to a 7. The landing was a little more difficult to control because of the pitch tendency, and trying to exercise a reasonable sink-rate at touchdown, it resulted in it being quite long. I would go to a 7-1/2 on the landing, mostly because the airplane wants to pitch more readily now and there is a definite over-control tendency developing.

RUN 94-B PR: 8/8/8.5

Was with moderate turbulence. The tendency to porpoise is much more noticeable now, because of the turbulence. However, I can stop the porpoising tendency after a couple of cycles, but it just starts right up again. It seems like you can damp it out, then just have to be right back on it again to damp it out again. I would go about 8, 8, 8-1/2. The landing looked very firm to me. We were just starting a nose-down cycle

when we touched. It probably would have hit pretty hard. I feel like I can get close to the runway, but I can't really be precise with the touchdown sink-rate.

RUN 94-C PR: 8/8/8.5

Was with heavier turbulence. I would say the results were about the same. I was a little bit concerned about some of the g excursions that might show, when you once get a pitch going that I have to stop with some fairly large stick inputs, but I wasn't able to determine just what the normal accelerations were. There were a couple of times when I felt I was making fairly large inputs, resulting in a rather sharp pitch up or pitch down. I would leave it at 8, 8, 8-1/2.

DATE-RUN: 5/8/80-95 PILOT: R CONFIG: S44B

RUN 95-A PR: 8/8/8.5

Was in smooth air. The sensitivity on this one was very low. It takes a lot of stick motion to get any displacement in pitch. The forces get to be quite high. The PIO tendency is not so much due to the pilot input - it just seems to have a phugoid that you find you have a little trouble controlling. The ability to hold the glide slope is degraded, over the other ones, because of this very sluggish pitch control. I would put the control of the glide slope at about an 8. I would go 8 across the board, I'd say. Well now, I think I'd better move the landing, flare and touchdown, to about and 8-1/2. Make it 8, 8, 8-1/2, the main reason being the very sluggish, low sensitivity, result of the control slop. The airplane is still unstable, wanting to pitch up or down if you just let it go.

RUN 95-B PR: 8/8/8.5

Was with turbulence. Again, very sluggish response. Turbulence didn't seem to affect it as much as I thought it would. I was able to get the airplane down reasonably well on the glide slope, but I couldn't say that it was degraded too much. I am going to leave it at 8, 8, 8-1/2. Landing turned out a little better than I thought it would. We kind of just squeezed in on a low sink-rate portion of a cycle in pitch. Turbulence didn't seem to cause the workload to go up exceptionally.

RUN 95-C PR: 8/8/9

Was with heavier turbulence. About the same results again, except that I floated down the runway a little more and the landings were a little unpredictable. I would go to 8, 8, and 9 on the configuration this time.

DATE-RUN: 5/8/80-96 PILOT: R CONFIG: S45

RUN 96-A PR: 5/5/5

Again unstable, but sensitivity was quite high. Able to control the airplane quite well on glide slope and localizer. Touchdown looked reasonably well. Tendency to PIO is there, but it seems to be rather easily damped and the forces are very light because of the increased sensitivity. I'd go about a 5 with it for all three. It didn't present any real major problems. The workload is a little high because of the tendency to PIO with a higher sensitivity, but it was well controlled I thought. Leave it at a 5 for all three.

RUN 96-B PR: 6/6/6

With some turbulence. Didn't create any real big problems - no appreciable increase in tendency to over-control. There is a PIO tendency there, but because of the high sensitivity, it can be damped out quite easily. I would probably go about 6 across the board. Just slightly long on the landing, but I was reasonably close to where I wanted to be. The sink-rate looks reasonable.

RUN 96-B (Accidental repeat of 96-B) PR: 6/6/6

Was with an increase in turbulence. I can't say that I could see much difference in it. I would leave all three ratings at a 6. It is still reasonably close to touchdown point, and there is no big tendency to over-control. However, you just have to stay right on it, because of the small control inputs are easily seen and the airplane is quite nimble. Very high sensitivity on the controls. But it flys pretty good.

RUN 96-C PR: 6.5/6.5/6.5

(See runs after 5/8/80-98-R for comments.)

DATE-RUN: 5/8/80-97 PILOT: R CONFIG: S46

RUN 97-A PR: 7.5/7.5/8

Smooth air. Sensitivity has gone up considerably, and there is a much more noticable tendency for PIO. I would go about 7-1/2. The airspeed control doesn't seem to be too bad, but the period on the cycling is rather short. We don't get big displacements from the glide slope, but you have to stay right on it all the time because it is unstable, and relatively small inputs though can stop the pitching one way or the other. I think I would probably go a 7-1/2, 7-1/2, and 8.

RUN 97-B PR: 8/8/9

With turbulence. Tendency to porpoise is much more noticeable with this configuration now. But the sensitivity allows you to control it somewhat - enough to get it down. The period between cycles, in terms of pitching up and pitching down, is quite short. You are always on the control - always spiking it to stop the pitch tendency. Because of the good sensitivity, it seems to get reasonably close to what you want. I would still place it at about an 8, 8, a 9 in terms of the ILS, the VFR, and the landing.

RUN 97-C PR: 8/8/9

Was with heavier turbulence. I can't say there was a big difference there. The main thing is to try to keep the porpoising down with small inputs. I would leave it at about the same, an 8, 8, and a 9. My landing was quite long that time. I had gotten some pretty good oscillations going and just had to hold it off, not let it touch until I could dampen out the tendency to oscillate and keep the sink-rate down, which I was finally able to do. We did have to make a go around on the first run, (got into) some fairly heavy porpoising that I just couldn't seem to calm down and touch down. But I felt the airplane could be gotten on the ground, but it is getting very marginal.

DATE-RUN: 5/8/80-98 PILOT: R CONFIG: F4

RUN 98-A PR: 7/7/7

Was with no turbulence. Sensitivity very low - very sluggish airplane. Not what I would call big tendencies to porpoise. Just have to be sure that you don't get into any PIO'ing. The airplane seems to hold its pitch attitude if it isn't disturbed too much, but once it's disturbed, it has a tendency to go off one way or the other since it is unstable. The airplane was reasonably good, in getting it down on the ILS, for the condition it is in. I would make it a 7 across-the-board. The main problem is, once you do have to make an input, it is very slow to respond to the stick. Because of the low sensitivity, the forces get quite high.

RUN 98-B PR: 7.5/7.5/8

With some turbulence. Again turbulence doesn't seem to disturb the airplane. It wants to hold its attitude, although once it starts it, it tends to diverge in either direction. I didn't feel like the turbulence created excessive workload. I would go a 7-1/2, 7-1/2, and a 8. The biggest problem with the landing was tending to be long, making sure your inputs were small, not letting your sink-rate get too high. There seems to be a little phugoid that you have to account for, that is on top of any inputs that the pilot might make, and if you can get on the right side of that, in other words, keep the sink-rate low and just let it float along, you can get a landing out of it. But it isn't too accurate.

RUN 98-C PR: 8/8/9

Heavier turbulence. Didn't have too much trouble. Right at the first the airplane, as I mentioned earlier, seems to hold its pitch attitude in turbulence - doesn't disturb it much. However, once it's disturbed, it is a little slow getting back to where you want it to be. I'd go 8, 8, and a 9. The landing looked quite firm to me. It was just getting behind the inputs the pilot was making. At the last, it looked like it kinda was just rounding out in a high sink end of a phugoid there as it touched. It looked like it had come out of it all right, but it was a good firm landing. It's just to the point of not being controllable, I would say on landing.

RUN 96-C (for Run 5/8/80-96-R)

When we ran 96-B and -C on the initial conditions (run before 5/8/80-97-R), it turned out that 96-C was actually B - it hadn't changed - so we came back at the end of these runs (5/8/80-98-R) and have repeated 96-C. I made a run on 96-B again just to recalibrate myself and then took a look at heavier turbulence. The airplane is fairly high in sensitivity and seems to be easy to control. Once it starts to pitch, it takes very small inputs on the stick to get the attitude that I want. It is flyable, however it's unstable. I would probably go about 6-1/2 across on the airplane. It is not too bad on instruments and not too bad on VFR. I was able to get it down. However, it's a little bit long on the touchdown; I broke out a little bit high, I think, on the glide slope. But that looks like a configuration that you could land, even in a heavier turbulence.

DATE-RUN: 5/9/80-100 PILOT: A CONFIG: S63

RUN 100-A PR: 4/4/5

Feel forces, sensitivity, directional control are all OK. Pitch response: a little abnormal, it seemed a little bit unstable, but there was plenty of control to take care of it, it looked like. Special inputs: just a little bit of attention, but no real problem. Airspeed control took a little attention. Glide-slope acquisition and maintaining glide slope were a 4. Visual: I think I noticed a couple of minor little pitch glitches, discontinuities in the visual pitch (system), following the smoothness of the rest of it, but was no effect. Lateral maneuver wasn't required. It seemed possibly just a little harder than the ILS, but not much - call it a 4. The flare and touchdown seemed to be a little cagier - call that a 5. [The visual system had discontinuities - glitches, jumps, steps - which the test pilot felt were sufficiently small that he would discount them and that they would not offset his ability to evaluate the configuration. These continued throughout the 5/9/80 runs.]

RUN 100-B PR: 4.5/4.5/5

Effect of turbulence made the instability noticeable. However, the aircraft tracking of glide slope still didn't seem to be degraded. The compensation required to keep pitch steady was increased a little bit, but as far as the turbulence and compensating for that and maintaining glide slope, it wasn't really increased that much. I could call it a 4-1/2 for the ILS glide-slope portion. Visual seemed about the same - call it also a 4-1/2. The flare-touchdown still a 5.

RUN 100-C PR: 5/5/6

The effects of turbulence just continually make it a little tougher. The ILS is a 5. The visual portion is still about the same, a 5. The flare-touchdown is a 6.

DATE-RUN: 5/9/80-101 PILOT: A CONFIG: S23

RUN 101-A PR: 3/3.5/3.5

Feel forces, sensitivity, lateral-directional all OK. Pitch response: again a noticeable problem with controlling pitch, instability or something going on there, but as far as controlling glide slope and airspeed, it was no real problem at all. Glide-slope acquisition, maintaining glide slope: I didn't have any problem at all maintaining glide slope. Although it was a mildly aggravating situation, it was perfectly controllable. Guess I'll have to call it a 3 for the ILS. Visual: might be just slightly harder, but that could be possibly due to the glitches that we have had in the visual (system) - call that a 3-1/2 and the flare touchdown a 3-1/2 - no real problems.

RUN 101-B PR: 5/5/5

The effects of turbulence on the problem was very noticeable and deteriorated the ability to control the airplane considerably. The ILS glide-slope portion is a 5. The visual perhaps didn't seem quite that bad, but we'll still call it a 5, and the flare touchdown is a 5.

RUN 101-C PR: 6/6.5/6.5

The effect of heavy turbulence continues to make maintaining the proper pitch attitude very difficult, consequently everything else begins to degraded. The ILS glide-slope portion is a 6, the visual is a 6-1/2, and the flare-touchdown also a 6-1/2.

DATE-RUN: 5/9/80-102 PILOT: A CONFIG: S21

RUN 102-A PR: 7/6/6

Forces, sensitivity, directional OK. Pitch response is very unstable and I've got good control, but it takes a considerable amount of effort to stay on top of the pitch. If I can keep the pitch under control, I can keep the airplane under control. It doesn't seem to change vertical speed too immediately with pitch changes, but airspeed control and pitch response or pitch control is just considerably difficult. The ILS glide slope and maintaining glide slope - you really can't do it and maintain it within limits - I'd call the ILS glide slope portion a 7. Visual, if anything seemed just slightly easier, I'd call the visual a 6 and the flare-touchdown a 6. It just seemed like I was able to kind of get things stabilized and get it landed more or less where I wanted to - where I just couldn't really quite fly the ILS glide slope.

RUN 102-B PR: 8/8/8

The turbulence just magnifies the problem of the pitch instability and makes it much more difficult to fly. The ILS glide-slope portion is an 8. The visual this time seemed the same, it's also an 8. The flare-touchdown is an 8.

RUN 102-C PR: 8/8/8

The effect of heavy turbulence seemed to be about the same as the combined effect of the moderate turbulence and lateral maneuver before. ILS is an 8. Visual is an 8. Flare-touchdown an 8.

DATE-RUN: 5/9/80-103 PILOT: A CONFIG: AFO

RUN 103-A PR: 1/1/1

Forces, sensitivity, directional is OK. Pitch response seems solid as a rock with no undesirable tendencies at all. The airspeed control was also solid, and the only problem I had with it was getting bored and not paying attention. I guess you pretty much have to call it a 1 for ILS glide slope. Visual is essentially the same and flare-touchdown. Just 1, 1, 1.

RUN 103-B PR: 3/3/3.5

The effective of turbulence seems to be more on the vertical speed than it is on pitch, and the same wonderful characteristics we saw that kept the pitch so nice and tight, work against you here because now it takes some very deliberate action to correct for glide-slope changes, and it actually works against you and makes it more difficult to track the glide slope than it should for this turbulence case. This condition probably puts it at a 3 for the ILS glide-slope portion, a 3 for the visual, and a 3-1/2 for flare-touchdown.

RUN 103-C PR: 5/5/5

The effect of turbulence continues to aggravate the problem. It just plain moves the airplane around and changes the speed, but there is very little speed stability and trim change. The pitch just seems to sit where its at and the airplane heaves up and down. In order to make it respond, you have to pitch it, and the stability makes that somewhat difficult in heavy turbulence. It's a 5 for the ILS glide-slope portion. The visual - here it seemed about the same, also a 5. The flare-touchdown also a 5.

TEST ENGINEERS NOTE:

Run 103-A was such a pleasant contrast to the three increasingly difficult configurations just prior to it, that the pilot waxed ecstatic about it - rated it much too favorable with three 1's. However, when he found the configuration to be adversly affected by turbulence, he was so disappointed, frustrated, that he down-rated it too severely, especially in the heavy turbulence. This configuration, AFO, was specifically inserted to "recalibrate" the pilot by giving him a good configuration for comparison.

DATE-RUN: 5/9/80-104 PILOT: A CONFIG: S62

RUN 104-A PR: 5/4/4

Forces, sensitivity and lateral-directional control OK. Pitch response: there's an instability problem that had to be continuously countered, but there was good control to do it with. Airspeed didn't seem to be too much of a problem. Maintaining glide slope was a 4. Visual was better. I seemed to be able to settle it down much easier looking at the visual. Also, we are still getting a couple of the pitch glitches, but they don't seem to be really a problem. I can ignore them. They are quick enough that they are not really compromising the set up. Visual seemed easier. I call it 3 and the flare-touchdown a 3. OK, on Run 104-A, let's just down-grade all the ratings one notch. Make it a 5 for the ILS and 4 for visual and flare-touchdown. The pitch instability that has to be countered is not really satisfactory, without improvement, but the workload associated with it really isn't that much of a problem. But due to the fact that it is an unacceptable situation, from the pitch and stability standpoint, I think we'll call it a 5 for ILS, and a 4 for visual and flare-touchdown.

RUN 104-B PR: 5/4/4

The turbulence doesn't seem to add materially to the problem. It bounces the pitch around, but does not seem to heave the airplane up and down very much. The control is good, and countering the pitch instability or the turbulence induced pitch movement is essentially the same - you can't really tell the difference. Airspeed takes a little bit more attention. But as far as maintaining glide slope and visual, it is essentially the same as before - 5 for the ILS, and 4 for visual, 4 for flare-touchdown. Flare-touchdown is really no problem at all. I haven't had any PIO tendency whatsoever.

RUN 104-C PR: 5/4/4

Again, no additional degradation due to turbulence, even in the heavy turbulence case. Remains as before - 5 for the ILS, and the visual is easier and the flare touchdown is no problem at all - visual a 4 and the

other a 4. The workload, actual compensation required, for all the cases is perhaps slightly easier than the ratings would reflect. The rating is based, in these cases, more on the question of a deficiency that warrants improvement. You really just can't call that kind of pitch instability acceptable. It should also be noted that the flare-touchdown, in all three cases, even with the heavy turbulence, was no PIO tendency, no problem whatsoever.

DATE-RUN: 5/9/80-105 PILOT: A CONFIG: S60

RUN 105-A PR: 5/6/6.5

The feel forces, sensitivity, lateral-direction are OK. Pitch response: noticeably unstable airplane. The sensitivity is down just a shade from what I feel would help to keep it under control nicely. Airspeed control is a little bit difficult, but not too bad. It takes a lot of attention to maintain the glide slope, primarily due to keeping the pitch under control - that's a 5. Visual seemed a little more difficult, with PIO tendency, and that would be a 6. The flare-touchdown: I just had a bad feeling about it, and I am not sure that I got the flare that I wanted, and I sensed a very treacherous kind of PIO tendency. Maybe I didn't let it happen, or it didn't happen to me, but I felt that I was just on the ragged edge of it. I would call that a 6-1/2 for flare-touchdown.

RUN 105-B PR: 7/6/6

The effect of turbulence was very noticeable and made flying the ILS glide-slope portion very difficult. I was unable to maintain all the parameters within reasonable limits. Something was out all the time. That is a 7 for the ILS. But the visual didn't seem to be any worse, really, than the first case. I'll call the visual portion a 6, and the flare touchdown also a 6. Perhaps the previous case, the flare touchdown was perhaps just an anxiety or guarding against something that might happen, but on this case, with the actual turbulence, the expected divergence and PIO tendency just didn't materialize, and it was a solid 6.

RUN 105-C PR: 8/6.5/6

The effect of turbulence seemed to have its most serious effect on the ILS glide-slope portion. I really wasn't able to maintain that at all. It was just a fight to keep everything going. The ILS glide-slope portion is an 8. But surprisingly, in the visual, I was able to recover from the situation and settle everything back down. Considering the fact that I was out, I just was not where I wanted to be when I broke out on the visual, due to the poor ILS, so I was actually able to fly it back - the lateral maneuver and so forth - and get the airplane back into reasonable shape. Call the visual portion a 6-1/2 - had a little bit of trouble with lateral and the flare-touchdown a 6.

DATE-RUN: 8/9/80-106 PILOT: A CONFIG: S61

RUN 106-A PR: 4/3/3

Feel forces, sensivity, directional, OK. Noticeable instability in pitch, but good pitch response and ability to control it. No particular PIO tendency. Airspeed control, not much of a problem. Maintaining the

glide slope is a 4. Visual is easier without a doubt than the ILS portion in this one. As soon as I was able to see what I was doing it was not a problem to fly at all. It's really a 3, and flare-touchdown the same thing. It flies like a 3 even though the instability is noted. Once I could see, they almost took care of themselves.

RUN 106-B PR: 4/4/4

Turbulence was noticed but not really a problem. Didn't really change the overall problem on the ILS glide-slope portion at all. It is a 4. It made the visual portion essentially the same as the ILS glide-slope portion and it is a 4, and the flare-touchdown is a 4. No real problems, but it did take the same level of effort as the ILS, whereas without turbulence it was considerably easier than the ILS. The impression, on the effect of turbulence, is that it seems to bounce the nose around but not really anymore than the natural tendency of the airplane to bobble itself around due to pitch inputs, and so forth. It gives the impression of being essentially insulated from the turbulence or the effects of it. The vertical speed didn't really vary much and the airplane did not seem to heave or change its flight paths, so it was super easy to fly in turbulence.

RUN 106C PR: 5/4/4

The effect of turbulence was very noticeable in bouncing the attitude of the airplane around. Also the heavy gusts began to have a pretty good effect on heaving the flight path around, and it took noticeable more effort. The ILS glide-slope portion is a 5. However, as far as the visual portion, I was able to settle it down better than I had on the glide slope. It's a 4, and the flare-touchdown is still a 4. I had just good control in the flare, in spite of the turbulence and in spite of the instability of the airplane.

DATE-RUN: 5/9/80-109 PILOT: A CONFIG: S25

RUN 109-A PR: 5/4/4

Feel forces, sensitivity OK. Pitch response seems just weak. The whole response of the airplane seems a little bit soggy. It's not a crisp airplane. Airspeed, has problems in controlling that. There is no particular trim feel, trim stability, speed stability of the airplane. It takes larger inputs than I like to get the pitch to move around, and it is not very stable. It doesn't like to stay where you leave it, and you just have a soft control of it. ILS portion is a 5. Visual: no lateral maneuver was required, but it did seem easier. It's a 4. Flare-touchdown was a 4.

RUN 109-B PR: 5/4/4

The effect of turbulence was noticeable, but suprisingly didn't increase the workload for any of the maneuvers at all. They still remain the same as before: ILS a 5, visual a 4, and flare-touchdown a 4. Again, the airplane just didn't seem to respond to the turbulence. The pitch was aggravated a little bit, but it wasn't as much problem as I anticipated from the 'A' case. Turbulence not that much of a factor.

RUN 109-C PR: 6.5/6/6

The effect of heavy turbulence, which does tend to move the airplane around, did make it considerably more difficult to fly. The ILS glide-slope portion is a 6-1/2, and the visual is a 6, and the flare-touchdown a 6. The difference between the 'B' and 'C' run, with the turbulence, seemed to be just surpassing a threshhold of turbulence where it really did begin to make a difference.

DATE-RUN: 8/9/10-110 PILOT: A CONFIG: S26

RUN 110-A PR: 4/4/4

Again forces, sensitivity, directional OK. Pitch: noticeably again a mildly unstable airplane. Good control over it. Airspeed fairly controllable. ILS glide slope, maintaining glide slope was 4 - difficult enough to warrant extra attention, but not really a problem maintaining the parameters well. Visual: was essentially the same - couldn't really tell too much difference - a 4. Flare-touchdown also a 4.

RUN 110-B PR: 5/5/5.5

The effect of turbulence was noticeable. First impression was that the airplane seemed pretty insulated from it, but it did make a difference and the farther we got down, the more noticeable it became. There is a PIO tendency - it is tricky to control and the gusts really don't help. ILS glide-slope portion is a 5. The visual, again about the same, remains pretty much a 5. There was a very definite PIO tendency noticed right in the flare-touchdown area, but I think we will call this a 5-1/2 for flare-touchdown.

RUN 110-C PR: 6/6/6.5

Effect of turbulence continues to be noticeable. ILS is a 6, now, and the visual again is the same, a 6. The flare-touchdown, there is very definitely a PIO tendency, but it still doesn't preclude getting the airplane down pretty much where you want it. However, I think we will call it a 6-1/2. It is really just borderline.

DATE-RUN: 5/9/80-111 PILOT: A CONFIG: S27

RUN 111-A PR: 8/7/7

Feel forces, sensitivity, directional OK. Pitch response: WOW! a very unstable airplane and very difficult to control it. I'm able to keep the pitch under control, barely, with considerable amount of effort. Maintaining glide slope - just can't do it and keep all of the parameters within acceptable limits all the way down. I managed to keep herding the thing down generally, and in reasonable shape. The visual was definitely easier. The ILS glide-slope portion, we'll call it an 8. The visual portion, definitely a PIO tendency close in, but it is not as bad. I guess I'll call it a 7, and the flare-touchdown also a 7.

RUN 111-B PR: 8/8/9

Effect of turbulence was very definitely a detriment. It didn't look like it at first, and it didn't have as much influence on the ILS portion because that was already pretty bad, but it definitely degraded the visual. ILS portion is still an . The ' ual portion is an 8, and the flare-touchdown is a 9.

RUN 111-C PR: 8/9/10

The turbulence again doesn't have too much more adverse influence on the ILS portion than without turbulence - that remains pretty much an 8. But the effect on the visual is really bad. The visual portion is a 9 and the flare-touchdown is a 10. It is just totally unmanageable.

DATE-RUN: 5/9/80-107 PILOT: R CONFIG: S24

RUN 107-A PR: 5/5/5

Was in calm air. The airplane was unstable longitudinally, but the sensitivity and all was such that it wasn't too difficult to fly. I would put it at a 5 for glide-slope acquisition. There wasn't any real tendency for a PIO to develop. Forces were quite light, and response seemed to be fairly good. The VFR was no particular problem either. I didn't notice any tendencies to porpoise when we broke out VFR. I think I would give it about a 5 across. Didn't see any big trouble with it other than the fact that it was unstable.

RUN 107-B PR: 5.5/6/6

Was with moderate turbulence. Workload went up a little bit due to turbulence. Again I didn't see any porpoising tendencies. As far as the ILS is concerned, I think I would go to about a 5-1/2. Probably about a 6 and 6 on the visual and the touchdown and landing. I got reasonably got close to where I wanted to land. It didn't float on me or tend to porpoise much, but I found that I was uping my workload quite a bit to accommodate it.

RUN 107-C PR: 5.5/6/6

Was with heavier turbulence. I couldn't say that I could see too much difference there. I think I would leave it about the same. It dosen't seem to be upset much by turbulence, but the pitch response if it does go seems to be reasonably good. I'd leave it at 5-1/2, 6, and a 6.

DATE-RUN: 5/9/80-101 PILOT: R CONFIG: S23

RUN 101-A PR: 5.5/6/6

With smooth air. Sensitivity was satisfactory, force levels were OK, but the airplane tended to PIO more and I had a tendency to overcontrol it a little bit more, possibly due to too high a sensitivity. I could stay reasonably close to the glide slope. But I noticed I was tending to fly a little bit on the high side, and for quite a while I couldn't seem to get it to go down to the glide slope. But it didn't give me any particular problem, particularly after breaking out. I'd put it at a 5-1/2 on the glide slope, and probably a 6 and 6 on the VFR and approach and landing. Still has reasonably good landing characteristics even though it is unstable. I could get pretty close to what I wanted with it and I felt like sink-rate was under control.

RUN 101-B PR: 6/6/6

Was with moderate turbulence. The workload went up as a result of this turbulence and I had a little more trouble staying on the glide slope. I'd go to a 6 on flying the glide slope under VFR. But I had amazingly good response when I broke out. I was a little high, but I was

able to get the airplane down and reasonably close to the touchdown point. Had good control of it considering the shape of the system. It surprized me that it worked out as well as it did. I think I will just stay at a 6 and 6 for the VFR and the landing and touchdown.

RUN 101-C PR: 6/6.5/6.5

Heavier turbulence. The IFR portion of it was still satisfactory as far as effects of turbulence. I didn't see any real big change there. I'd leave it at a 6. However, the tendency to PIO under visual conditions was more noticeable now. I ended up landing quite a bit longer than anticipated. I had a little trouble getting it down in what I would call acceptable sink-rate. I ended up floating quite a ways. I'd go to a 6-1/2 on the VFR and the landing.

DATE-RUN: 5/9/80-102 PILOT: R CONFIG: S21

RUN 102-A PR: 7/7/7.5

Was calm air. There is very noticeable tendency now for a PIO to be generated because of the fast response of the airplane. Stick forces are light, sensitivity is quite high. It is very easy to overcontrol the airplane. Very difficult to hold a pitch attitude because of its unstable condition. I'd put the ILS at about a 7. I was able to break out reasonably close to the right altitude, but the workload is getting quite high. Under VFR conditions, I felt like it was maybe a little bit easier to handle, but I still was porpoising the airplane. I think I would still stay with a 7. The landing, I'd go to about a 7-1/2. It is controllable yet in terms of its ability to check sink-rate, but it is causing a lot of oscillations on the stick and noticeable porpoising all the way down. So I would go about a 7, 7, and a 7-1/2.

RUN 102-B PR: 8/8/8

Was with moderate turbulence. I had several gyrations in pitch there, that time, trying to get back to the glide slope that took some fairly high excursions. The airplane is very sensitive. Sensitivity is high. I didn't know, again, what kind g maneuvers we were pulling. I wasn't watching it (g meter). But I got the impression it could have been a little on the high side for some of the porpoising that went on. I would go to, probably, at least an 8 on the ILS that time. When I broke out, I had to check a fairly large change in pitch attitude, but I was able to correct it because of the high sensitivity. Probably leave the VFR at about an 8. The landing: I was able to come down and make a half-way decent landing out of it. It surprised me that I was able to damp out the pitching oscillations - come close to the ground. Although it went a little bit long, I was able to get it down. Workload is high. I would put it at an 8 also.

RUN 102-C PR: 8/8/8.5

Was with heavier turbulence. I'd probably leave it about an 8 for the IFR portion of it. I found that if I could keep my inputs down low, and make more corrections but less magnitude on the stick, it would settle it out a little bit. I found that, on the landing, I was a little uncertain as to what kind of a sink rate I could control to get down to the ground. It looked like a fairly firm landing, but I think it was a satisfactory

one. But, I'd probably go about 8 still on the IFR, about 8 on the VFR and 8-1/2 on the landing.

DATE-RUN: 5/9/80-103 PILOT: R CONFIG: AFO

RUN 103-A PR: 3/3/3

Looked like an airplane that had some static stability to it. I didn't notice any diverging tendencies in pitch. However, the sensitivity was a little bit low, or it was sluggish, a little more than normal. I'd go 3 across the board with it. I didn't see any real big difference between IFR and VFR, and the landing worked out all right. I was able to get it where I wanted, but just a little slow to respond. I'd call the sensitivity a little bit on the low side, or the force level can get up a little bit. There doesn't seem to be an initial response to stick movement. But, it's not a difficult airplane to fly.

RUN 103-B PR: 3.5/3.5/3.5

Was with moderate turbulence. I'm trying to decide whether turbulence bothered it any, it didn't really seem to pitch it one way or the other. It was still reasonably easy to control in the turbulence, as far as the glide slope was concerned. However, I did get a little bit high, when on the glide slope prior to breaking out, and I wasn't able to correct for it sufficiently to get the airplane down in the touchdown zone when I finally did break out and make the landing. But, I didn't find myself overcontrolling it at all. I think I would go 3-1/2 across the board.

RUN 103-C PR: 3.5/3.5/3.5

Was with heavier turbulence, but I am not going to change my ratings. I am going to leave them right around 3-1/2. The airplane is easy to get down, considering the turbulence level, but the fact that it is a little bit sluggish, sensitivity-wise, hasn't bothered me too much in terms of getting it where I wanted to go. Again I broke out a little bit high on the approach when I got VFR, and got a little bit past touchdown point on the landing. But it responded quite well to inputs. Turbulence doesn't seem to kick it off much. So leave them at 3-1/2.

DATE-RUN: 5/9/80-104 PILOT: R CONFIG: S62

RUN 104-A PR: 5/5/5

Was with calm air. Forces are light. Sensitivity is fairly high. No noticeable PIO tendencies, however. Airplane flew pretty well, but it was unstable. I got the impression that I could fly it fairly accurately. I could hold the glide slope reasonably close to "right on", and didn't give me any particular problem. I would go about 5 all the way across. Touchdown was reasonably good. The only thing that I really would fault it on was the fact that it is an unstable configuration, longitudinal. But because of the high sensitivity and the lack of tendency to PIO, I guess I wouldn't call it high sensitivity but adequate sensitivity, and the lack of tendency to PIO, I could fly it quite well.

RUN 104-B PR: 6/5.5/5.5

With turbulence. I probably noticed some tendency to PIO, a little there at times, because of the turbulence. I would probably go about a 6

on the IFR portion. I got the impression that once I got VFR, though, I could handle the airplane a little bit better. I could notice small tendencies to PIO and damp them out a little easier under VFR conditions, and I wasn't as apt to overcontrol it, there, as much as I was under IFR. So I think I will go 5-1/2, 5-1/2 on the VFR and the landing, and put it at a 6 on the ILS. I might say that, that is one of the first times I can remember where I was having less trouble under VFR conditions than I was under IFR conditions. But I was just concentrating on making inputs smaller, I guess.

RUN 104-C PR:

Was with heavier turbulence. I think I would go 6 all the way across the board. I would leave the ILS at a 6, and go 6 on VFR and landing conditions. I tended to land a little bit short, and I had a little bit of trouble getting lined up at the last there. I might have broken out just a little bit high, and not quite lined up with the runway, but the airplane is controllable but unstable.

DATE-RUN: 5/9/80-105 PILOT: R CONFIG: S60

RUN 105-A PR: 8/7/7

Was in smooth air. The configuration is definitely unstable and I had a lot of trouble controlling the PIO tendencies. Sensitivity is quite high. Force levels are low. Just a tendency to overcontrol it. I was having more trouble trying to hold the glide slope under IFR conditions. Tend to have too big inputs at times, and got some fairly large porpoising tendencies out of it. I would go to at least an 8 on the IFR portion of it. I think I would come back to, under VFR and approach a landing, back to a 7. I was able to keep my inputs smaller and eliminate the tendencies for PIO'ing somewhat under VFR conditions. I thought the landing worked out reasonably good. Airplane wants to diverge from its attitude quite rapidly once it starts.

RUN 105-B PR: 8.5/7.5/7.5

Was with moderate turbulence. It was again difficult under IFR conditions because of the tendency to PIO. Had some fairly high excursions in pitch, but I was able to damp them - the sensitivity is pretty good. Control response was good to the inputs, but it is just impossible to hold it on a body attitude or pitch attitude, to hold a glide slope for instance. Airspeed control is somewhat difficult because of the PIO excursions, but I didn't worry about holding it too close. The ILS, I would have to put at an 8-1/2. The VFR and the landing portion of it are about 7-1/2. They are not too bad for the type of instability that I am seeing here.

RUN 105-C PR: 8.5/8.5/8.5

Was in heavier turbulence. I can't say I could tell much difference between the moderate and heavy turbulence, that time. I would leave the ILS at 8-1/2. I would go to 8-1/2 on the VFR and the landing also. I did notice more tendency for PIO'ing under visual conditions, but I was able to damp it quite easily. It might take 2 or 3 oscillations to damp it out, but the airplane is responding so fast that there is very little change in altitude, so I don't see any big effect of an altitude change in

the PIO tendencies. I felt like I could work it down to where I could get a landing out of it without damaging it. But the instability of it is the thing that's really causing the high workload now. 8-1/2 across.

DATE-RUN: 5/9/80-108 PILOT: R CONFIG: S22

RUN 108-A PR: 8.5/7.5/7.5

Calm air. Still an unstable airplane in pitch. I noticed a little more tendency to porpoise this time. The sensitivity, I think, has dropped a little bit. Force levels seem to be a little bit high to control the porpoising. However, I felt like I had control of it. It was a little more sluggish response. The airplane didn't seem to want to respond quite as quickly as some of the other configurations I've seen. When it did take off, maybe it was a little slower in diverging or departing from the pitch attitude, but I found it a little hard to hold the pitch attitude constant. I had to force myself to keep control inputs down, or the stick inputs down. I would probably go about 7-1/2 across the board on this one. Didn't like the response in the VFR, and the landing, quite as well as little higher sensitivity that I have seen before. But its adequate to fly the airplane, even though it is quite unstable.

RUN 108-B PR: 8.5/7.5/7.5

Was with some turbulene. I tended to PIO it more under IFR conditions than I do under visual. I noticed that the excursions in PIO tendency are a little more slowly observed, or I should say the period between oscillations is a little longer, so it results in a possible sink-rate excursion maybe being a little on the high side for the touchdown at times. So I ended up floating quite a bit that time, didn't quite get to my touchdown point. But I'd probably go about 8-1/2, 7-1/2, and a 7-1/2. Again, I find it easier to fly visually than under instrument conditions. Sensitivity is good enough that I can get a reasonable response on the stick, but just can't hold the attitude constant for any given length of time.

RUN 108-C PR: 8.5/8/8

Was with heavier turbulence. I'd go 8 1/2, 8 and an 8. I did notice, on the landing, that just before touchdown a gust or something hit me that caused me to float for awhile, but I don't think it was caused by inputs. Sensitivity is high enough that I've got pretty good control of the airplane. I don't think it was a ballooning, as a result of a control input, but it did take awhile to float it along the runway to get it back down again. I tend to use smaller inputs, once I get VFR, and the airplane seems to damp out a little better. I seem to like it better under VFR conditions than IFR.

TEST ENGINEERS NOTE:

Pilot R seemed noticeably fatigued on this set of runs (108) and the next set (110), the last for the simulation session. The achieved performance on both sets of runs looked, to the test engineer, better than the pilot ratings indicated. Neither configuration looked as bad as the ratings.

DATE-RUN: 5/9/80-110 PILOT: R CONFIG: S26

RUN 110-A PR: 7.5/7.5/7.5

In smooth air. Again the airplane is unstable, but I could control it reasonably well. No noticeable PIO tendencies that were giving me any trouble. The sensitivity if fairly high on it. I don't find myself using any high stick forces to fly it. I guess I would have put it at a 7-1/2 across the board. I didn't notice any particular problems that were bothering me other than the fact that it is quite unstable and ready to diverge in either direction if you let it go.

RUN 110-B PR: 8.5/8/8

Was with turbulence. I put it at probably about an 8-1/2 under IFR, and an 8 under VFR and for the approach and landing. I have to fight it all the way down, but it doesn't cause any uncontrollable tendencies to PIO. The sensitivity is good enough to stop any tendency to want to pitch either way rather quickly. It doesn't divert very far from the glide slope or flight path when you do start a tendency to pitch up or down. The control forces to get it back to its original condition are not bad at all.

RUN 110-C PR: 8.5/8.5/8.5

Was with heavier turbulence. It can get into a PIO tendency quite easily, but again, spiking of the column seems to damp it rather quickly. Sensitivity looks reasonably good. I was fighting it quite a bit that time on the ILS, but I can't say that it was any different than the other. I'd probably go about 8-1/2 across the board with it. Under VFR condition, I had some pretty good excursions in pitch as a result of some large inputs, but I was able to damp them out quite readily. On the landing, I ended up being long and just working the sink-rate down. But even though there was some significant attitude changes, it didn't seem to have a big effect on the vertical speed as I could see it VFR. I think I could get the airplane down reasonably good with the instability that is there. But I think the main thing is that the sensitivity is such that it will stop the porpoising tendency quite rapidly. After just one or two spikes on the column, you can get back to a reasonable attitude for touchdown or for holding the glide slope. About 8-1/2 across.

DATE-RUN: 5/17/80-121 PILOT: A CONFIG: AF2 ($\dot{\delta}_{h_{LIM}} = \pm 35^{o}$/sec)

RUN 121-D PR: 2/3/3/3

Forces, sensitivity, lateral-directional all OK. Pitch response is good, no PIO tendency or special inputs. Airspeed control is no real problem. The ILS glide-slope acquisition and maintaining glide slope, with turbulence off, was very good, a 2. Turbulence degraded it a little bit and I will call the ILS portion below 900 feet a 3. Visual: no lateral maneuver was required and it was about the same as the ILS, a 3. The flare-touchdown is a 3.

RUN 121-C PR: 4/4/3

The effectiveness of turbulence is noticeable in that it makes controlling the glide slope more difficult. The airplane heaves, goes up and down, and takes some compensation to do what you want to do with it.

It takes some definite pitch changes to get through the turbulence. We'll call the ILS a 4, the visual a 4, and flare-touchdown, that wasn't too much of a problem, that will be a 3.

DATE-RUN: 5/17/80-122 PILOT: A CONFIG: AF2 ($\dot{\delta}h_{LIM}$ = ± 20°/sec)

RUN 122-D PR: 2/3/4/3

The initial visual portion, without turbulence, pitch response is very precise and ILS glide slope, airspeed control all very good - it is a 2. In turbulence, it is noticably a little more difficult and takes a little more attention, making definite pitch corrections as before - ILS portion in turbulence is a 3. Visual portion seemed about the same except the lateral maneuver caused a bit of a problem. Kind of a tendency to overshoot a little bit, and I am not just sure what the problem was. It may have been just a little farther to go than I had before, but it complicated things. I will call the visual portion a 4, and the flare-touchdown a 3.

RUN 122-C PR: 5/8/10

The initial portion of the ILS, turbulence was making a difference. It seemed more difficult to counter than before. It's a 5. In visual, it got into something I really don't understand, but I begin to very definitely have the airplane get away from me. The visual suddenly deteriorated to about an 8, and it was gone. Well, there wasn't really any flare-touchdown at all. It just went away this time - about a 10.

DATE-RUN: 5/17/80-123 PILOT: A CONFIG: AF2 ($\dot{\delta}h_{LIM}$ = ± 10°/sec)

RUN 123-D PR: 3/3/10/10

The initial portion, the inbound, the pitch response was not quite as precise as the previous case. No particular PIO tendency noted, behaved fairly well. It was a 3. ILS portion with turbulence, again initially it seemed reasonably well controlled. It seemed somewhat insulated from the turbulence itself, but was well behaved. It took reasonably small pitch corrections to keep everything under control, and it remained a 3. The visual however, something very strange happened. Apparently the pitch input that I put in was enough to begin a PIO situation that deteriorated, in about two to three cycles, to something that was completely uncontrollable and it just went immediately to a 10 and there was no flare-touchdown.

RUN 123-C PR: 5.5/10/10

The effect of turbulence was very noticable. On the ILS portion, didn't seem to be too much of a PIO tendency, but it was noted. We were able to maintain reasonable parameters on the ILS glide slope, but it took considerable effort - probably a 5-1/2. The visual: once again, as we broke out, the PIO tendency set in and without really recognizing the magnitude of the pitch variations required, within about three cycles we reached a point where the airplane was just totally gone. The PIO tendency in the visual, just total it to 10. As in the previous case, there was no flare-touchdown. The airplane was totally uncontrollable in the visual portion, it's a 10, and we never made it as far as the visual touchdown.

DATE-RUN: 5/17/80-124 PILOT: A CONFIG: AF6($\dot{\delta}h_{LIM}$ = ± 10°/sec)

RUN 124-D PR: 3/4/10/10

The pitch response was fairly good as long as I kept the inputs small. I did fool around a little bit and noticed that if I got rough on the controls and used moderate inputs, there was definitely a PIO tendency that went away as soon as I limited the pitch movements and the inputs to a very small amplitude. Without turbulence, it behaved reasonably well. A little bit bouncy in the pitch response - not quite as precise as I would like - call it a 3. The ILS portion with turbulence was noticeably more difficult, but not too bad, probably a 4. I was still able to maintain the glide slope with small inputs, and by use of the attitude indicator was able to make sure that the pitch excursions were small enough to stay out of trouble. The visual however, without the precise knowledge of the pitch attitude, again by getting sucked into a very strong PIO tendency, in about three cycles the magnitude of the pitch and the control inputs and such, it was just totally gone. I lost complete control of it, in about three cycles, and that is a 10 for the visual. There was no flare-touchdown. Additional comment on that: It is appropriate to note at least that with a good HUD system, the visual may have been salvageable, in having good solid precise pitch information to prevent the excursions from getting into the range where we got into the PIO. Then it might have been possible to have flown it and landed it. But without good cues in pitch, you just lose it.

RUN 124-C PR: 7/10/10

The effect of heavy turbulence on this run was substantial enough to cause considerable problems with the ILS portion. You just can't quite keep the input small enough - you have to make big ones - and it is destabilizing. I was not able to maintain glide slope, localizer, and airspeed all within reasonable limits simultaneously and continuously. Its a 7. When we went to the visual, the same situation - small corrections began to just overshoot and, within a couple of cycles, the PIO tendency was totally uncontrollable - a 10. No flare touchdown.

DATE-RUN: 5/17/80-125 PILOT: A CONFIG: AF1 ($\dot{\delta}h_{LIM}$ = ± 10°/sec)

RUN 125-D PR: 2.5/3.5/3.5/3

The initial ILS portion, pitch response seemed fairly good. The airspeed control was not difficult and it seemed to track fairly well. Call the portion without turbulence a 2-1/2. Turbulence definitely degraded it, took a little more effort to get things to do what I wanted it to do, but still was not bad. Call the ILS portion with turbulence a 3-1/2. Visual portion: the PIO tendency did not seem to be there, although I think I was a little gun-shy of it, and I didn't do the job that I wanted to do. But I'll call the visual portion the same as the ILS, a 3-1/2 - it seemed about the same. The flare-touchdown: a 3, although I happened to be a little further down the runway then I wanted to be. That was kind of an overly wariness of the last two disasters.

RUN 125-C PR: 4/10/10

The ILS glide-slope portion didn't really seem all that bad with heavy turbulence. Overall, averaged about a 4. It seemed a little easier in the beginning and a little tougher at the end. The visual portion initially didn't look too bad. I thought I was going to be able to fly it

okay, and then it just began to develop a PIO that, once it started, I couldn't get it back. So it is a 10. There was no flare-touchdown. We didn't make it that far.

DATE-RUN: 5/1/7/80-121 PILOT: T CONFIG: AF2 ($\dot{\delta}h_{LIM}$ = ± 35°/sec)

RUN 121-B PR: 2/3/3/3

The feel forces were normal. Sensitivity was normal. The pitch did not seem more sensitive than the baseline airplane. Lateral-directional was normal - no problem with pitch response - no PIO tendency - no special inputs. Airspeed control - no problems with it other than turbulence induced deviations. The ILS portion, prior to 900 feet where there was no turbulence, glide-slope acquisition was normal and maintaining the glide slope was normal and I will rate that a 2. The ILS, from 900 feet on down with moderate turbulence, I'd downgrade to 3. The visual: pitch control was no problem - lateral maneuver required some maneuvering to get back to the centerline, but that was no difficulty. The visual seemed about the same as the ILS in difficulty. I will rate the visual and flare and touchdown as 3.

RUN 121-C PR: 3/4/4

The turbulence, through the ILS portion and the initial portion of the visual, did not seem much heavier than the moderate turbulence on the previous run. I'm going to rate the ILS portion a 3. The visual and flare and touchdown, I am going to downgrade to 4 because of the turbulence effects on the airplane performance. I received a jolt of turbulence near the flare, and it took more effort to get the airplane back over to the runway and into the touchdown zone. So 4 for flare and touchdown, and visual.

DATE-RUN: 5/17/80-122 PILOT: T CONFIG: AF2 ($\dot{\delta}h_{LIM}$ = ± 20°/sec)

RUN 122-D PR: 2/3/10/10

The feel forces were normal. Sensitivity appeared normal. The pitch response on the inbound portion did not present any problem - it seemed to have a normal pitch response. Small change in pitch movements of the stick moved the airplane pitch as I expected. PIO tendency - didn't have any. No special inputs. Airspeed control was no problem. Initial portion of the ILS glide-slope acquisition was normal, maintaining the glide slope was normal. Initial portion of the ILS, prior to 900 feet, I rate as 2. After 900 feet when moderate turbulence came in, I downgrade that to a 3. The visual, initially when I broke out. I was left of the runway centerline, I corrected over - lateral response appeared to be normal. But the pitch control, in the visual and flare and touchdown, the airplane went out of control. Initially, it pitched up. Then I pushed the stick forward to correct back to the glide slope and the airplane, again, over-pitched and continued pitching down on full aft-stick and the airplane did not respond. So airplane control was lost about half way through the visual maneuver. The visual, flare and touchdown are a 10.

RUN 122-C PR: 5/10/10

The turbulence during the ILS portion caused greater compensation to keep within desired performance limits. I will rate the ILS portion as a

5. As soon as I broke out, I had the airplane under control during the visual portion of the glide slope. But the visual glide slope apparently causes the pilot to induce greater pitch movements to make corrections to the glide slope than when on the ILS. By doing this, the aircraft went out of pitch control, whereas it appeared to be under control during the ILS portion of it. In the visual and flare touchdown, the airplane could not be controlled, the airplane would not respond to pitch - again a long period oscillation the stick would not bring back. So I am rating the visual and flare and touchdown as a 10.

DATE-RUN: 5/17/80-123 PILOT: T CONFIG: AF2 ($\dot{\delta}h_{LIM}$ = ± 10°/sec)

RUN 123-D PR: 2/4.5/10/10

The feel forces appeared to be normal. The airplane initially seemed to have normal pitch sensitivity. Lateral-directional was normal. The pitch response on the inbound portion was no problem. There was no PIO tendency. No special inputs. The inbounds portion was without turbulence. There was no airspeed control problems either. ILS glide-slope acquisition and maintaining glide slope between 11,000 and 900 feet was normal. I would rate the initial ILS portion as a 2. When the turbulence came on at 900 feet, I began noticing the aircraft pitch response changed. The airplane could go into a small amplitude PIO's and pitch while I was correcting back to the glide slope. I rate the ILS portion between 4 and 5, for below 900 feet, rate it 4-1/2 below 900 feet. When I broke out, the airplane initially was controllable in pitch, but soon the pitch went out of control. Regardless of stick inputs, I could not keep the pitch under control, so the visual and flare and touchdown are a 10 again. The visual appeared to be about the same difficulty as the ILS. However, the inputs that I was putting in, after I got on the visual, again made the airplane go uncontrollable as opposed to being on the ILS when I had it under control.

RUN 123-C PR: 5/10/10

The turbulence causes the pilot to excite a divergent oscillation that, if I don't let it get too great, I can bring it back under control. It's easiest to keep under control during the ILS portion where the deviations from the glide slope are not too large and therefore, the control inputs are naturally not very large to get back to the glide slope. I'll still rate the ILS portion, prior to visual, as a 5. When I broke out on the visual portion - I want to note here that I ran a repeat to see if the same effect would happen - I broke out on the visual portion, you can see the need for larger corrections and this tends to make you put in slightly larger corrections, just large enough to induce this divergent oscillation. Once it gets going past a certain amplitude, it's uncontrollable. The visual and the flare and touchdown are rated 10. The airplane went out of control in pitch. There also seemed to be some pitch-roll coupling because of the pitch oscillations. During the ILS portion, the roll seemed to be slightly more unstable, but this is the first time I have seen this in any of these runs. I want to note that during the repeat of this Run 123-C, I tried to integrate the ILS glide-slope deviation indicator into my cross-check as I made the visual approach, to see if I could get the airplane on the ground by also using instruments. But the large deflections of the glide-slope indicator

induced the same overcontrol that excites this oscillation, as you do by just using just strictly visual methods.

DATE-RUN: 5/17/80-124 PILOT: T CONFIG: AF6 ($\dot{\delta}h_{LIM} = \pm 10^{o}$/sec)

RUN 124-D PR: 2/3/5/5

The feel forces seemed OK. The sensitivity seemed normal. Lateral-directional seemed normal. Pitch response on the inbound portion was no problem. No PIO tendency. Airspeed control had no problems. Glide-slope acquisitions was normal. Maintaining glide slope was normal. I'll rate the initial glide-slope portion a 2. After 900 feet, the turblence added to the difficulty in maintaining the glide slope. I'll rate the ILS portion a 3. The visual and touchdown, the first time through on Run 124-D, the airplane appeared to go out of control in pitch. On the second run, I was displaced laterally quite a bit from the runway centerline, but I got the airplane back over to the runway and the pitch remained under control. However, I had a feeling that the airplane was an incipient case of going divergent if I put in too much pitch correction to get back to the glide slope. I felt like I was very close to exciting this type of divergent oscillation. So I am going to rate the visual and the flare and touchdown a 5.

RUN 124-C PR: 5/10/10

With heavy turbulence. The turbulence required greater effort, so I'm rating the ILS portion as a 5. As I broke out into the visual, I was off the glide slope and put in corrections. I put in what I considered to be adequate corrections, as I would put in if this were a completely normal, stable airplane. I did not try to avoid any divergent pitch mode, as if I hadn't pre-knowledge of it. I tried to ignore that fact and I put in a normal magnitude of pitch control, and I apparently excited the divergent oscillation. I pitched up and used forward stick, and the airplane was slow to respond. Finally, it responded, and it over responded and pitched down. I put in increasing back-stick, and finally full back-stick, with no response and the airplane was out of control. So the visual and flare and touchdown are 10.

DATE-RUN: 5/17/80-126 PILOT: A CONFIG: AF0 ($\dot{\delta}h_{LIM} = \pm 10^{o}$/sec)

RUN 126-D PR: 3/3/4/4

The feel forces, sensitivity are all OK. Lateral-directional is still good. Pitch response is not as precise as the previous case that was not recorded (AF1 with full control rates). It tends to be just a little bit wishy-washy, but no PIO tendency. It takes just a very slightly more deliberate effort to stick the airplane where you want it, and a little bit of attention in keepting it where you want it. Airspeed is a little bit soggy, as far as airspeed control. ILS glide-slope acquisition, maintaining glide slope is fine. It's a 3 on the non-turbulence portion of it. Below 900 feet which is with turbulence, its essentially the same, it is really no more difficult. It's about a 3. Visual: noticed a little bit (of a) tendency for the thing to not want to do what I wanted it to do, particularly on short final. Call the visual portion a 4. The flare-touchdown, I'm not so sure what was going on there either, it sort of seemed like it was trying to behave, and then I wasn't really sure of it. I'll call it a 4 also.

RUN 126-C PR: 4.5/7.5/9

The turbulence had a very noticeable influence on destabilizing the approach. I kept changing my mind continuously, as we went down the glide slope, trying to decide whether its a four or a five. So I'll call it a 4-1/2 for the ILS portion. I broke out visual and noticed a very strong tendency towards a PIO. I was able to keep it under control for the most part during the visual portion, and I would call that probably a 7 for the visual - let's make it a 7-1/2 for the visual. I'll make the flare-touchdown - although I think it came out alright - it was a 9. I felt it was borderline. I am not so sure, whether it was luck or timing or just what, but we didn't seem to crash it but it looked like it was just on the verge. Flare-touchdown is a 9.

DATE-RUN: 5/17/80-127 PILOT: A CONFIG: F6 ($\dot{\delta}_{h_{LIM}} = \pm 35^{o}$/sec)

RUN 127-D PR: 4/4.5/7/7

Forces, sensitivity OK. Lateral-directional OK. Pitch response: of course we knew the red light was on, and there was definitely an instability that had to be continually countered. No particular PIO tendency noticed. It just took special continual attention to stay on it, even in the still-air case. Airspeed control was a little bit soggy. The instability seemed slow and it wasn't too much of a problem to take care of. Still-air case for the A (inbound) portion is a 4. When we get into the turbulence at 900 feet, initially, for the first half of it, it really didn't seem that much more of a problem. When we got a little farther down, it became a little more difficult. I'll call it a 4-1/2 for the turbulent portion. The visual was a little more difficult yet. It definitely had a tendency to want to get away from me which I managed, this time, to keep under control by minimizing the pitch excursions and the control inputs. But it still appeared that the visual portion would have to be about a 7. I really didn't get it where I wanted it, but there didn't seem to be much problem with actually controlling it. The flare-touchdown is also a 7. As far as making it flare-I really didn't - it just kind of landed. I really didn't have any control problem yet. So it's a 4, a 4-1/2, and a 7 and a 7 for the visual and touchdown.

RUN 127-C PR: 5/6/7

Turbulence definitely made much more workload out of the deal. A 5 for the ILS portion. The visual portion seemed to have less of a tendency, even, to get away this time. The fact that I had no lateral maneuvering to make, and less upsetting tendency to it, the visual portion I would call this time a 6. But the flare touchdown still remains a 7 because I just didn't seem to be able to get the kind of flare I wanted out of it, and position the attitude to make a flare. It just kind of landed anyway, in spite of everything, so the flare will be a 7, but the visual we call a 6.

DATE-RUN: 5/17/80-128 PILOT: A CONFIG: F6 ($\dot{\delta}_{h_{LIM}} = \pm 20^{o}$/sec)

RUN 128-D PR: 4/6/6/6

First of all, the forces, sensitivity, lateral-directional are all OK. The pitch response: again noticeably unstable, but in the portion without turbulence, there was no PIO tendency or real problems with it

except you had to constantly attend to pitch to put it where you wanted it. When you did, you got what you wanted out of the glide slope. Airspeed is a little bit soggy. Its a 4 for the no turbulence case. When you get to the ILS portion with turbulence, it's considerably more difficult. It tends to upset, and you just have to really work hard to keep the thing within parameters. 6 for the ILS below 900 feet. Visual was about the same. It seemed a little bit easier to control the pitch on the visual this time than during the ILS with turbulence, but a little bit harder to control the sink-rate on the visual than on the ILS. Overall, it remained a 6, and the flare-touchdown is a 6.

RUN 128-C PR: 6/5/5

The effect of turbulence considerably degrades the ability to fly the ILS. It is a 6 for the ILS, but near the end, it's a borderline seven, but we'll call it a 6. The visual portion for some reason is actually easier to fly than the ILS portion, particularly with no lateral maneuver required. It felt more like a five for the visual portion. The flare-touchdown seemed about the same, but it also was apparent that, at that time, the really violent random gust that we get out of our heavy turbulence model did not occur at that point. But for this particular run, it would be a 6 for the ILS, a 5 for visual, and a 5 for the touchdown.

DATE-RUN: 5/17/80-129 PILOT: A CONFIG: F6 ($\dot{\delta}_{h_{LIM}} = \pm 15^{o}$/sec)

RUN 129-D PR: 4/5/6/6

The forces, sensitivity, lateral-directional are OK. The same instability as before, just a continual problem keeping the pitch where you want it, but when you do, the airplane responds OK. The initial ILS portion is a 4. The airspeed control is a problem, but not too serious. It just kind of squishes around - it doesn't go where you want it to go. The ILS portion below 900 feet with turbulence is more like a 5. It's just a lot more difficult to keep the parameters where you want them. The visual: with the lateral maneuver that I got to see a little on the late-side because I broke out just a shade high, was tough, but I still managed to get it around where I wanted it although I had kind of a late wings-level just before flare. I call it a 6. Flare and touchdown was kind of hard to judge, but I'll call it a 6, because I did think I got it where I wanted it, but it was just a bit of a struggle particulary coming out of a late lineup. The visual might have looked better if I hadn't had such a tight S-turn to be required to make from a late break-out on the ILS. If I had a little more time, a little more of a straight away, a little less of an abrupt lateral maneuver, it might not have been quite as tough to do.

RUN 129-C PR: 7/6/7

The effect of heavier turbulence makes flying ILS pretty tough. I was not able to keep all three parameters in bounds all the time. It's just coming up on a 7. The visual portion seemed to be just a little bit easier again, and I was able to recover to a certain extent from being a little bit out of shape off the ILS. That would be a 6 for the visual, but the flare touchdown again wasn't quite as good and I call that a 7.

DATE-RUN: 5/17/80-130 PILOT: A CONFIG: F6 ($\dot{\delta}h_{LIM}$ = ± 10°/sec)

RUN 130-D PR: 3.5/6/6/6

Forces, sensitivity lateral-directional are OK. Pitch response was noticeably slightly unstable, but it didn't really present much of a problem in the still-air case - little inputs. It had pretty precise control although it wanted to drift off after you stuck it someplace, though you got very good response out of it. For the still-air case, I kind of vascilated between a 3 and a 4 - we'll call it a 3 1/2 for the still air-case. The ILS and maintaining glide slope, once when we got into the turbulence, got progressively more difficult until we got down near the end. So I guess we would have to call that about a 6. I watched it steadily deteriorate from a 4, and I kept changing my mind downward the farther I went with it, until at the end I even wondered if maybe it ought to be a 7. But we'll call it a 6 for the ILS portion. The visual seemed slightly easier, and allowed me to kind of pick it up and get it back a little bit, but it was very definitely kind of a problem. There was a tendency to overcontrol it, that you had to resist, but maintaining the pitch attitude was not really difficult. It was just a matter of getting control of the sink-rates and not letting it get out of hand. We'll call the visual portion a 6, and the touchdown a 6.

RUN 130-C PR: 8/10/10

The ILS glide-slope portion kind of ran the spectrum of looking like a 6 at first, but then being apparent that it was at least a 7, and then getting really tough. Near the end of it, I would call the ILS glide-slope portion close in as an 8 in turbulence. So we'll call it an 8. The visual portion, this time, just kind of got out of hand and I never really did settle the visual portion down. We'll call the visual a 10, and we didn't get a flare-touchdown.

DATE-RUN: 5/17/80-1125 PILOT: T CONFIG: F1 ($\dot{\delta}h_{LIM}$ = ± 10°/sec)

RUN 1125-D PR: 4/7/10/10

Inbound, the feel forces were normal - the sensitivity was normal - lateral-directional was normal. Pitch respnse: I noticed a tendency for the pitch attitude to overshoot where I wanted to put it. It seemed to be a divergent type of pitch response, but I could dampen it out and stop the pitch attitude, then stair-step it back to where I wanted it. No problems with airspeed control. ILS glide-slope acquisition, including the just mentioned remarks here, required more effort than normal but I didn't notice any real problem without turbulence. ILS, prior to turbulence, would rate as a 4. Below 900 feet with turbulence, I was not able to keep the airplane within the desired ILS glide-slope performance limits. I would rate the ILS portion 7. The visual, flare and touchdown: the airplane pitched down at one point there, and with back-pressure added to it, I could not bring it back under control. So I would have to rate the flare and touchdown as a 10.

RUN 1125-C PR: 8/9/9

This was done with heavy turbulence and it increased the amount of pitch changes that were required to try to correct back to the glide slope. I wasn't able to keep it within desired performance limits, so I

am rating the ILS as an 8; and visual, flare and touchdown as 9. You have to use maximum effort to try to keep the airplane under control throughout the visual portion.

DATE-RUN: 5/17/80-1126 PILOT: T CONFIG: FO ($\dot{\delta}h_{LIM}$ = ± 10°/sec)

RUN 1126-D PR: 4/7/9/9

Inbound: feel forces, sensitivity were normal - lateral-directional normal. Pitch response: I noticed the tendency to overshoot the desired pitch attitude and it seemed to be divergent. So you did have a tendency toward the PIO. No airspeed control problems. ILS portion, prior to turbulence, glide-slope acquisition rate as a 4. Maintaining the glide slope with turbulence, I rate the ILS portion as a 7. The visual and flare and touchdown: I apparently excited the divergence again, and at one point I had full aft-stick in trying to bring the pitch back up. So I would rate the flare and touchdown 9.

RUN 1126-C PR: 6/8/8

We had greater turbulence on this run and I rate the ILS portion as 6, and the visual, flare and touchdown as 8. I believe what has happened is that I am learning how to fly this particular type of instability by using smaller stick inputs to get the desired performance that I want out of the airplane. Characteristically, I would use larger corrections to bring the airplane back to the glide slope, but if I do so, I excite the greater instabilities. So for this reason, I am rating the ILS 6, and the flare and touchdown as 8.

DATE-RUN: 5/17/80-128 PILOT: T CONFIG: F6 ($\dot{\delta}h_{LIM}$ = ± 20°/sec)

RUN 128-D PR: 3/5/7/7

The feel forces, sensitivity and lateral-directional all were normal. The pitch response, I noticed the tendency for the pitch to exceed the limits where I wanted to put it. I did use a special input of smaller stair-step pitch changes to get the pitch where I wanted it. So I'm cutting down the magnitude of my pitch movements to keep from exciting this instability. Glide-slope acquisition was, without turbulence, really not too difficult - just required minimal compensation - as well as maintaining the glide slope without turbulence prior to 900 feet. So I rate that portion of the ILS a 3. After that, the ILS became more difficult due to the turbulence, and I am rating that portion a 5. The visual: on the lateral maneuver I was offset, because of concentrating on pitch control, but the lateral didn't seem to be any more difficult. The pitch control required more effort. I didn't have it exactly where I wanted it. So I am rating the visual and flare and touchdown a 7. The visual didn't seem any more difficult than the ILS portion.

RUN 128-C PR: 6/7/7

I am rating the ILS portion 6, the visual and flare and touchdown 7. The greater pitch deflections, required because of glide-slope deflections, made it just that much more difficult. Throughout most of the glide slope, through the ILS portion, I kept the glide slope within half a dot. The flare and touchdown wasn't exactly where I wanted it to be, so I am rating that a 7.

DATE-RUN: 5/17/80-130 PILOT: T CONFIG: F6 ($\dot{\delta}_{h_{LIM}} = \pm 10^{o}$/sec)

RUN 130-D PR: 4/6/9/10

The feel forces, sensitivity and lateral-directional all appeared normal. Pitch response, I saw a slightly different pitch instability. The pitch was wandering other than where I wanted to put it. Seemed like it could be another case where I would excite it if I had large pitch corrections, and I would avoid them if I didn't. The glide-slope acquisition and maintaining glide slope required a little more effort, and I am rating them a 4 prior to turbulence. After turbulence, maintaining the glide slope was more difficult, in fact, it required maximum effort to keep it within half a dot deflection, and I'am going to rate that a 6. When I first broke out, the visual portion appeared to remain under control with maximum effort the way I wanted it to. But half way through the visual, I began to see that the pitch wasn't responding, and I couldn't really stair-step the pitch to where I wanted it, make it respond that way, and it took maximum effort from that point on to keep it under control during the visual. Then in the touchdown, I had full back-stick in with no response out of the airplane. It did happen to land on the runway, but I still think it was essentially out of control when it did. So, 6 for the ILS below 900 feet, 9 for the visual, and 10 for the flare and touchdown. There didn't seem to be any interference from the lateral maneuvers during the visual or flare and touchdown portion.

RUN 130-C PR: 8/10/10

The effect of turbulence was generally to require greater pitch charges to stay on the glide slope and therefore, greater stick inputs and greater opportunity to make the pitch go divergent. I am going to rate the ILS portion prior to turbulence a 4. (Pilot must be remembering the D run). After turbulence, the ILS portion I rate as 8. At times it almost went divergent on me. I couldn't keep it within a half a dot by any means. So I was working under maximum effort to keep it under control. Then the visual flare and touchdown went a 10 - went out of control.

DATE-RUN: 5/17/80-125 PILOT: T CONFIG: AF1 ($\dot{\delta}_{h_{LIM}} = \pm 10^{o}$/sec)

RUN 125-D PR: 3/5/10/10

The forces, sensitivity and lateral-directional all were normal. Pitch response: I noticed that the airplane did not overshoot the pitch attitudes that I was looking for. It seemed to stop where I wanted it. However, I could tell that there was something other than normal about the pitch response. There was no problem with airspeed control. Glide-slope acquisition and maintaining glide slope required just minimal compensation, so I am rating those 3, prior to turbulence. After encountering turbulence, I pretty much kept it within desired limits, but it required considerable compensation to do so. I am rating that ILS portion with turbulence a 5. I ran this 125-D twice. Both cases, the initial portion of visual approach seemed normal. I started getting low, and corrected for it in pitch, and it overshot the pitch response that I wanted, then it undershot it and went out of control. So both visual and flare and touchdown I rate as 10 - they went out of control. Lateral maneuvers didn't seem to enter into it, or correcting over to the runway centerline. The visual was more difficult than the ILS portion because of the way the aircraft responded.

RUN 125-C PR: 8/10/10

The further down the glide slope I went in this turbulence, the greater the oscillations became in pitch. Initially, I was flying a 5 on the ILS, and then it degraded to 6, and then finally it went out of limits prior to breaking out. I have to rate the ILS overall as an 8. Flare and touchdown: the airplane porpoised out of control again. So I am rating the flare and touchdown and the visual portion as 10.